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The Generation of Electricity.

THE Electricity Commissioners last week issued their "annual analyses and summaries of the returns of fuel consumption and units generated" in Great Britain for the year ended March 31st, 1927; the leading features of the returns are summarised elsewhere in this issue. The period covered by this publication included the general strike, as well as the prolonged dispute in the coal industry, which naturally had an adverse effect upon the output and operation of the generating stations, compelling them in many cases to use inferior fuel, and therefore the results recorded are in some respects abnormal.

Although 26 stations were closed during the year, 12 others came into operation, so that the number of stations from which returns were received (570) was only 14 less than in the previous year. The total output was 8,365,857,198 kWh generated, an increase of less than 3 per cent., whilst the fuel consumed, 8,856,938 tons, increased by 4.8 per cent., showing the influence of the exceptional conditions in both cases. The average fuel consumption increased from 2.40 to 2.43 lb. per kWh generated in steam stations, the best average result being 2.06 lb. for the stations in Group A—those which generate over 200 million units per annum—closely followed by 2.08 lb. in Group B, from 100 to 200 million units. Each group up to and including Group E (10 to 25 millions) shows an average of less than 3 lb., and these five groups produced over 90 per cent. of the total output. In the smaller stations the consumption rapidly rises to 13 or 14 lb. per unit in those producing less than 100,000 kWh per annum. Barton station (Manchester), with a load factor of 53.2 per cent., shows the excellent result of 1.33 lb., the thermal efficiency being 21.83 per cent., as compared with 1.36 lb. and 21.51 per cent. in the previous year, with a load factor of 41 per cent. The output from Barton was over 300 million kWh—a record, we believe, for a single station—the total output from the four Manchester stations being 411 million units. No other steam generating station approaches this low coal consumption.

The largest output under one management is that of the Newcastle-upon-Tyne Electric Supply Co., Ltd., and Associated Companies—over 600 million kWh from Carville, Dunston, and North Tees, and 714 millions from all sources, a very fine showing; over one-tenth of this was derived from "waste-heat" stations.

From an inspection of the figures it will be obvious that the quality of the coal used (which is not taken into account) varied widely, a high thermal efficiency being sometimes accompanied by a high coal consumption.

Energy derived from waste heat fell from 178 to 78 million kWh, as might be expected during so grave an industrial crisis; water-power-generated energy rose to 49 million kWh, a comparatively trifling contribution to the sum total.

Electrical Wholesalers and Others.

We have received a pamphlet regarding the objects and trading policy of the Electrical Wholesalers' Federation, together with a list of its 62 members in the London, Lancashire, Yorkshire, North-East Coast, Midland, South Wales and Scottish Sections. The information given in this pamphlet should be of interest to many traders who are eligible to be, but are not yet, included in the membership roll.

If we are to have organisations capable of efficiently watching over the various interests in the industry, it is desirable that they should be strong numerically and really representative. It is impossible for any body to exercise a real influence, whether they be manufacturers, contractors, wholesalers, or any other class, unless a considerable proportion of their kind are linked up together and are able to reach some common ground of agreement on essential matters. Success is more likely to ensue if it be made apparent that membership is open to all who really desire to help, and is not confined to a favoured few. All of the existing organisations have had their own particular problems or controversies more or less recently, and some of them are confronted with them in an acute form at the present moment. At times the onlooker, and the disinterested listener, may be pardoned for wondering whether the capacity for united action in some is lessening and whether others are to be regarded as having so far served their useful purpose as to make the time ripe for some big reorganisation affecting both themselves and others. It may prove that the various signs of unsettlement that appear from time to time really mean that the whole industry is groping toward some advanced state of organisation which shall enable it more profitably and satisfactorily to cope with the huge volume of electrical business that everybody expects within the next five or ten years. We may say at once that in so complex an industry we never have anticipated more than a human measure of harmony and co-operation, and whatever course future associated developments may take, we shall only live in tolerable peace and amity together when we have learned not to push our own particular views too far.

Let it not be regarded that the foregoing comments have any direct bearing upon the operations of the Wholesalers' Federation, for they have not, but when the doings of different bodies come under survey separately as they have done lately, one cannot dissociate them from thoughts that are uttered in our hearing respecting the position of the whole.

Referring directly to the list of organised wholesalers, we believe we are right in saying that, compared with the possible membership throughout the kingdom, their number is small, though most of them are important concerns. The Federation defines an electrical wholesale distributor as: "Any person, firm or company whose main business is electrical wholesale distributing, and who purchases and carries reasonable stocks on his or their own account for supplying to electrical contractors or others, and who does not cater for the retail trade and has no contracting (wiring) interests." Assuming that the Association is willing to open its doors wide to admit the large number of other eligibles, small though they be as individuals, we would suggest to those who have so far been acting on their own that they should obtain a copy of this pamphlet from Mr. J. W. McKay, the secretary of the E.W.F., at 19-21, Hatton Garden, London, E.C.1. It might be useful if wholesalers who withhold themselves from membership were to make known their reasons for so doing. Those who are content to reap the same benefits as others without lending a hand to secure them should abandon their selfish attitude.

D.O.T. Reports: Lack of Electrical Interest.

In this issue we review a report upon conditions in Belgium published by the Department of Overseas Trade. This deals very fully with the finances of the country, its tremendous reconstructional efforts and some of its industries. There is a chapter on the development of electric light and power, but the Belgian electrical manufacturing industry, which is of some importance, is not mentioned at all. As an electrical journal, we are bound to regard this as a most remarkable omission, but unfortunately it is one that is not uncommon in D.O.T. reports. Others recently received, such as those dealing with the United States, Germany, Italy and Sweden, have also dealt with the industry in a very perfunctory way.

It is beyond dispute that in all the countries mentioned, the electrical manufacturing industry is a considerable factor, and as such is deserving of more attention than has been devoted to it. Mr. Cahill, Commercial Counsellor in Paris, sets a good example in his reports upon French conditions; he invariably devotes a chapter to the activities of the electrical manufacturers, and his matter is of great interest.

Can it be that the nature of the reports depends upon the predilections of their authors? Or, if not, is it possible that in limiting the ground covered, they are acting upon specific instructions from the Department? Surely at this date the D.O.T. does not lack vision concerning the electrical industry!

We feel that far too much attention is devoted to matters of purely national importance to the neglect of those phases of activity which have a direct bearing upon the interests of British manufacturers and traders. The latter want to know what their competitors are doing, and they are of the opinion that it is part of the job of our accredited official commercial representatives to give them this information. We have so often written favourably regarding the value of the work done by the Department of Overseas Trade that we feel more than justified in alluding to this strange lack of attention to electrical matters in trade reports. Knowing the Department's appreciation of the value of news regarding electrical contracts that are going, we are at a loss to understand the lack of such appreciation in its official reports.

The Crompton Jubilee.

Congratulations are due to Col. R. E. Crompton on the interesting event which was celebrated last week, when a brilliant assembly of engineers came together in his honour and that of the company which he founded 50 years ago; "Cromptons" has passed through many vicissitudes but has triumphed over all difficulties, and by association with a young and virile firm has renewed its youth. Long life to the old-new company!

Those who recollect the lively but friendly rivalry between the two great leaders in electricity supply—Ferranti and Crompton—which added zest to the meetings of the Institution of Electrical Engineers a generation ago, cannot fail to be interested in the avowal of the former that it was the work of Crompton that induced him to embark on electrical engineering, at a time when the name of the new industry had hardly been coined. This fact, which was apparently news to Col. Crompton and afforded him the keenest delight, immensely increases our debt to the Colonel.

Heavy Electric Traction in Italy.

A review of the present position of railway electrification in Italy, and of recent developments in line equipment and rolling stock.

By THEODORE RICH.

(*Concluded from page 498.*)

Track Equipment.—*Continued.*

FIG. 10 shows a normal aerial turn-out. Taking phase conductors A and B on the left, the outer conductors run through without a break to A_1 and B_1, being, however, doubled for a few yards; an insulated dummy conductor DD drops down between the outer conductors. The two inner phase conductors A_2 and B_3 slope down to a position on each side of the dummy. A trolley on A, passing to the right, travels along to A_1. The bow on B picks

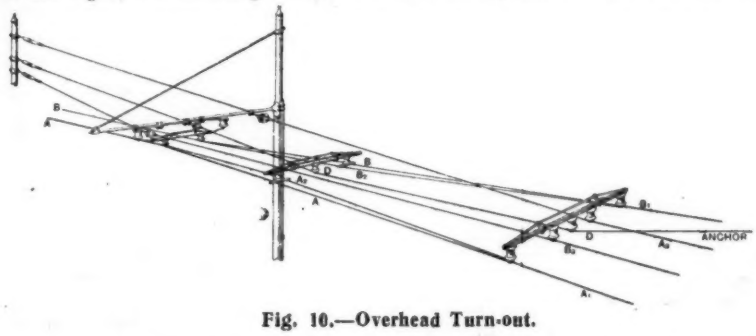


Fig. 10.—Overhead Turn-out.

up B_2 and picks up the dummy D, passing along it until it makes contact with B_3. The rear bow continues to make contact with B until the forward bow is well on to the new conductor B_3.

A bow from A passing to the left makes use of A_2, and the same dummy, going on to A_3.

Fig. 11 shows one of these aerial switches forming part of a cross-over road. One would think that there would be a good deal of flashing when going through a turn-out, but the writer found that in the dark the sparking was nothing beyond the normal.

In the older sections the supports are about 35 metres apart on the straight, reduced to 25 metres on sharp curves. A usual system is to place an h.p. line on each side of the double track, supported on steel Mannesmann or oval masts at intervals up to about 160 metres, and to provide short light intermediate posts to support the contact conductor.

Fig. 12 shows overhead construction in Spezia sidings. It may be noted that the horizontal final support is in the form of a bow-shaped section; this is clipped on to the bracket. This type of bow bar is used on curves on the main track and in sidings so that super-elevation can be allowed for.

In the Valtellina section twin conductors were used, each of 8 mm. diameter, or 100 sq. mm. per phase; in later lines, twin conductors each 11.3 or 200 sq. mm. per phase. On part of the latest extension to Leghorn, where the catenary system is used, one conductor is used as suspender, the other as contact; single conductors are usually used in sidings.

On the line to the south of Genoa, especially between Spezia and Leghorn, are to be found long stretches of comparatively level track over which high-speed running is possible, and some new types of equipment have been adopted which are much more flexible than the older ones. Fig. 13 shows one type of suspension with flexible ears with a sort of parallel motion. Fig. 14 shows a plain catenary type used on a stretch of line between Leghorn and Pisa; it has given very good results at speeds up to 100 km. (62 miles) an hour.

Portable Sub-stations.

An interesting feature of Italian railway operation is the use of portable sub-stations; fig. 15 shows one

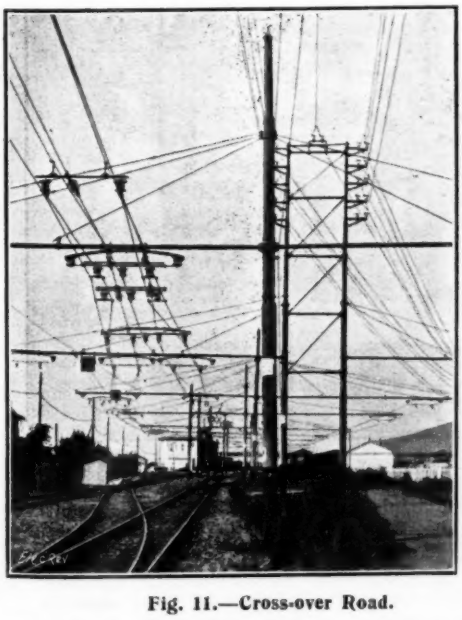


Fig. 11.—Cross-over Road.

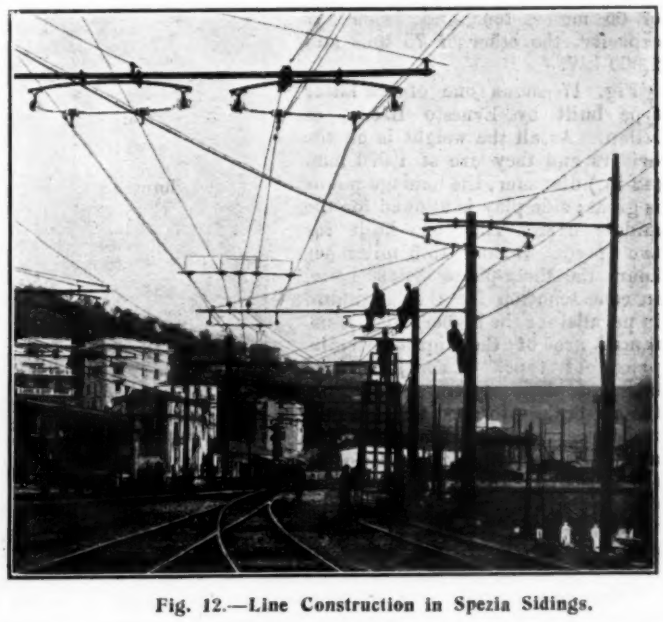


Fig. 12.—Line Construction in Spezia Sidings.

of these, made by the Savigliano Company. The h.p. line passes through outdoor terminals into the main switch tank, the gear being fitted with instantaneous and time overload relays; connection is made direct to the transformer, which is of 2,600-kVA capacity, arranged for 102,000 volts star connection, or 59,800 volts mesh;

the l.p. side can be tapped by special switches from 3,700 to 4,460 volts. An oil switch is also arranged on the l.p. side. An operating cabin with instruments and remote control gear is provided. The Italian Westinghouse Co. also supplied sub-stations of a somewhat similar type. Fig. 16 shows four sub-stations of the former type being used to supply power to the trolley lines pending the completion of a normal sub-station.

Electric Rolling Stock.

With the exception of 40 auto-cars for direct current, most of which are used on the pioneer Milan-Varese line, and 10 auto-cars on the Lecco-Sondrio three-phase line, of the type developed by Messrs. Ganz, the whole of the haulage is done by locomotives. Italy resembles the United States and Canada in that suburban traffic is largely left to tramways and private light railways; as in parts of Spain, some of the large cities still keep mainly within the old boundary walls. In Northern Italy much of the heavy traction was developed to deal with goods traffic through bottle-necks, and, further, many trains contain international stock for which the multiple-unit system cannot be adopted. Some of the heaviest haulage in Italy is connected with the northward traffic out of Genoa; a unique type of locomotive was designed to deal with it, a development of the Valtellina (Ganz) six-coupled type. These locomotives, known as the "Giovi type," of which about 400 have been built, have ten-coupled wheels, driven by two gearless crank-connected motors; they are built for collar work and not for speed, and are of two sub-types, one of 65 metric tons and 1,500 kW capacity, the other of 75 tons and 2,000 kW.

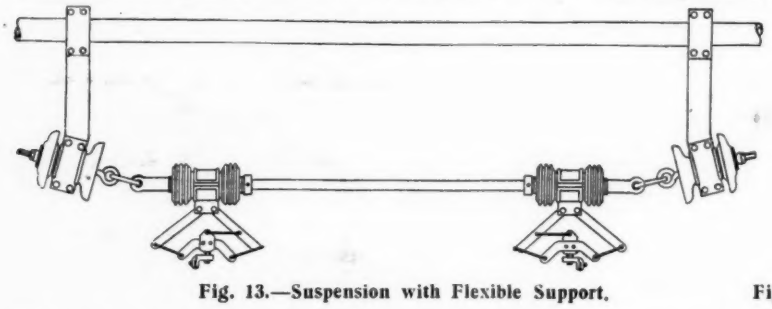


Fig. 13.—Suspension with Flexible Support.

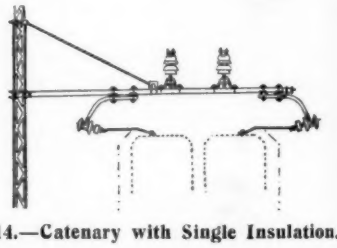


Fig. 14.—Catenary with Single Insulation.

Fig. 17 shows one of the latter type built by Ernesto Breda, of Milan. As all the weight is on the drivers and they are of 1,070 mm. (42 in.) diameter, the haulage power is great; side play is allowed for the middle axle. They are built for two speeds, 31 and 15.5 miles per hour, the three-phase motors being in concatenation for the lower and in parallel for the higher. The resistances are of the liquid air-displacement type. Each locomotive has two air compressors to supply the air brakes, to operate the liquid resistance, the reversing switches and other gear, and to hold up the trolley arms. One would think at first sight that the two trolleys close together at 4,000 volts difference of potential would give rise to a good deal of difficulty; in actual practice, as a rule, they require attention less than twice a year.

There are several types of locomotive for passenger service on the 3,600-volt three-phase sections. One type has four coupled driving axles with leading and trailing axles also, with two motors each of 1,000 kW, the total weight being 91 metric tons, with three speeds—23.5, 31.5, and 62 miles per hour.

Two further types have six-coupled drivers, each 66 in. in diameter, with leading and trailing axles, one group having two motors each of 1,000 kW, and the other two of 800 kW; each has four speeds, the first group with a maximum of 62 and the second 46 miles per hour.

For the line from Rome to Sulmona to operate on 10,000 volts, three-phase, 42-50 cycles, some interesting locomotives have been delivered; these have been tested on a branch line.

Fig. 18 shows a locomotive of the type made by Ernesto Breda, of Milan. There are two geared motors placed well up in the cab; the gear is spring connected. With 45 cycles, the speeds are 23.5, 31.5 and 46 miles per hour. At the lowest speed the motors are in cascade, each arranged for eight poles, the combined power being 1,860 h.p. on a one-hour basis. At the middle speed the motors are arranged with 12 poles each, and are placed in parallel, giving 2 × 1,250 h.p.; at top speed the poles are changed back to 8, giving 2 × 1,515 h.p.

The motors are fed by a three-phase transformer which reduces the pressure from 10,000 to 1,850 volts for cascade and 1,600 volts for parallel; the transformer is of 2,250 kVA capacity. It is oil cooled, with cooling circulation through a radiator; this can be seen on the right hand over the buffers. The transformer winding is in star on the h.p. side, and the l.p. side is arranged for two star circuits in parallel or in triangle; the latter connection is used for the 12-pole arrangement, the former when running with eight poles. The stator connection change is made by electro-pneumatically operated multiple-contact switches mounted on the motors. The rotors are connected up in two-phase for 12 poles, and six-phase for eight poles, the change coming about automatically with the change in the polarity of the stators; this arrangement has been patented by the Breda Company. As with other Italian three-phase locomotives, liquid resistances are used; the cooling in this case is by means of an air draught spray arrangement. Two auxiliary transformers are provided to feed the air compressors, pumps, fans, &c. The locomotive can operate on 6,000 volts by placing the transformer h.p. winding in triangle instead of in star; it can also

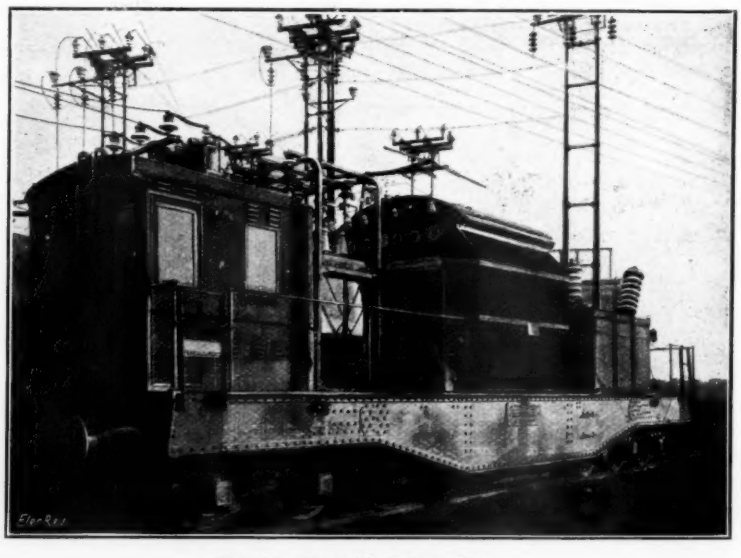


Fig. 15.—Portable Sub-station.

operate on 15 cycles provided that the pole connections of the auxiliaries are changed.

A visit to the locomotive running sheds and repair shops at Bussoleno, on the Turin-Modane line, proved most interesting. At this depôt 35 locomotives on the Modane section are dealt with, and a further 25 from the Turin area are handled also for repairs. Whatever

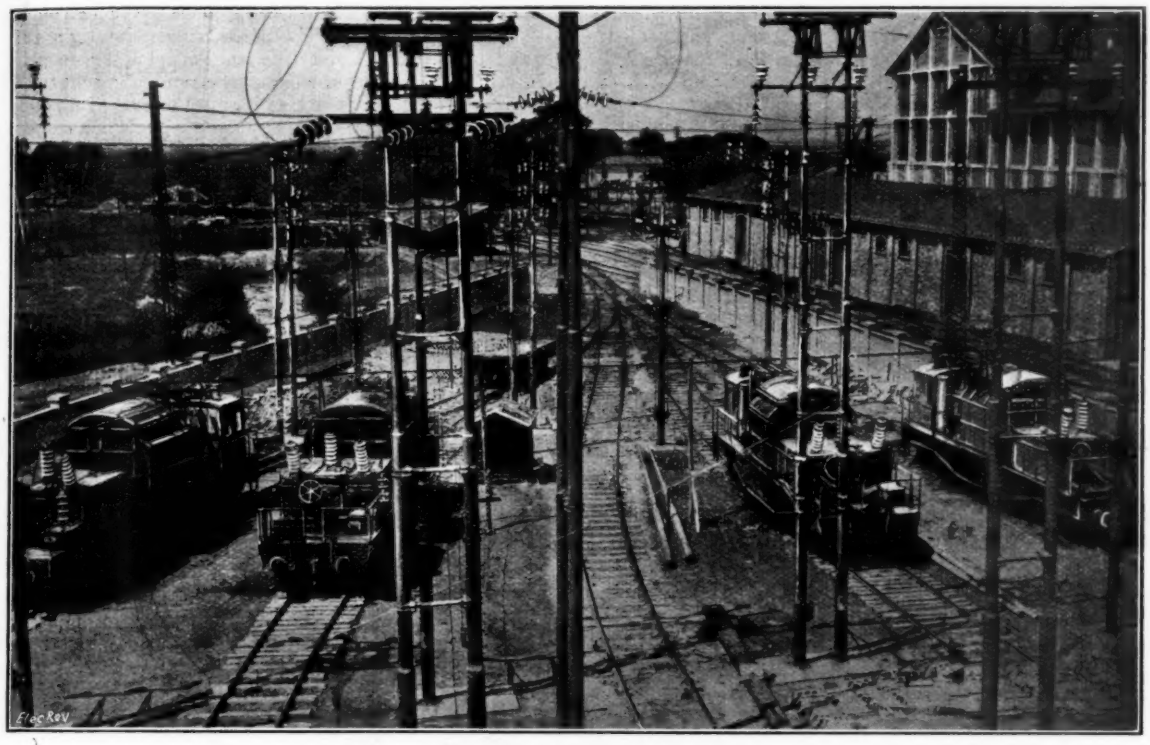


Fig. 16.—Portable Sub-stations in Operation.

criticism may be made about the three-phase system, the low maintenance cost of the locomotives forms a valuable feature. The large motors used are a thoroughly workmanlike job; there are two sets of bearings, the inner for the motor with ring lubrication, and the outer for the support of the cranks. The stator windings are

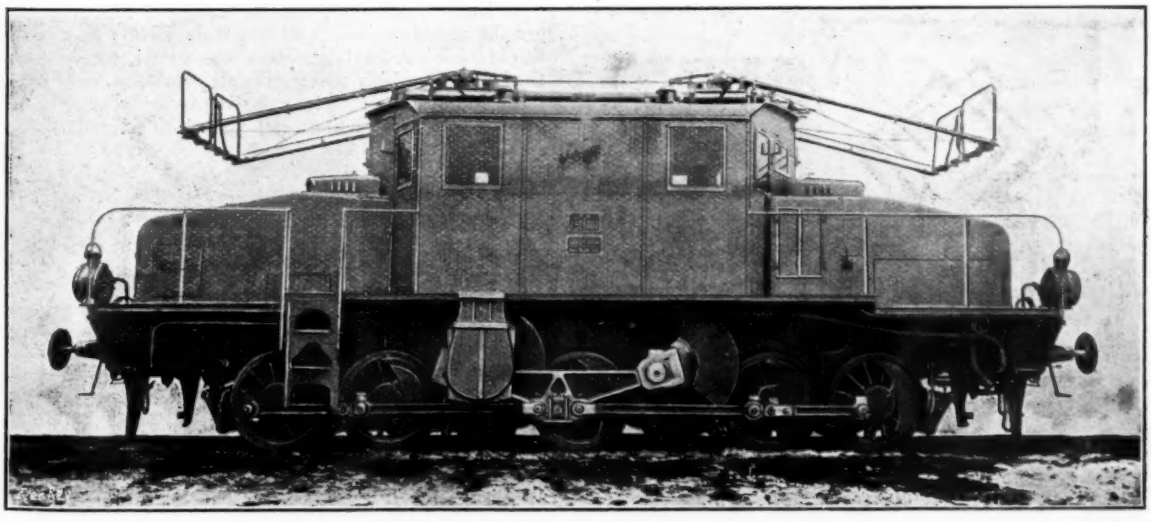


Fig. 17.—"Giovi" type Locomotive.

arranged in bar form, the ends of the bars being electrically welded up; the end windings are protected by annular castings, the whole being filled in solid with a bitumen compound after the stator has been heated up in an electric oven.

The main motors give so little trouble that only two winders are kept; sometimes six months go by without a main motor repair. Most electrical repairs relate to minor accessories. The liquid resistances for the rotors are in the form of tall, rectangular boiler-plate tanks, with a diaphragm and fixed-plate electrodes. The compressed air forces a solution of carbonate of soda in the lower part up into contact with the electrodes in the upper chamber; when it is full, the electrodes are short-circuited and the liquid falls back. The reversing is carried out by means of a capstan switch with multiple contacts; in the original form plunger contacts were used, now laminated circuit-breaker type flat switch contacts are used. the contacts lifting off, turning round, and then falling again. As compared with the banks of contactors required with normal direct-current and single-phase systems, the gear required for the main circuit with the Italian three-phase system seems ridiculously simple.

Regarding the vexed question of regeneration, the

three-phase system is very simple and almost fool-proof; the train is practically locked in to the system on a steep down grade. Apart from any question of saving in power, there is a great reduction in brake shoe wear. The direct-current regeneration systems are complicated, and most of them give openings for false manœuvring. It is quite an experience on a locomotive to run down the Giovi incline at 31 miles an hour on 1 in 28, with two locomotives ahead and one behind, with a heavy international passenger train of 305 tons, and compare it with the crawl down the valley on the French side of the Mont Cenis tunnel with steam locomotives.

The air brakes are adjusted so as to allow the locomotive to pump back about 500 to 700 kW. Regarding locomotive operation, on the Mont Cenis line, 20 trains a day can be handled easily, each of 350 tons, over grades of 1 in 33, with a section of single line, including a number of tunnels; it would be very difficult to handle such traffic by steam without doubling the line all through—a matter of great expense. On the Giovi line one steam locomotive could only handle 100 tons; now with goods trains 250 tons per locomotive is handled at a much higher speed; where 800 to 900 wagons per day could be handled with difficulty by steam, now 2,000 give rise to no anxiety, and 40,000 tons up grade is often dealt with per day.

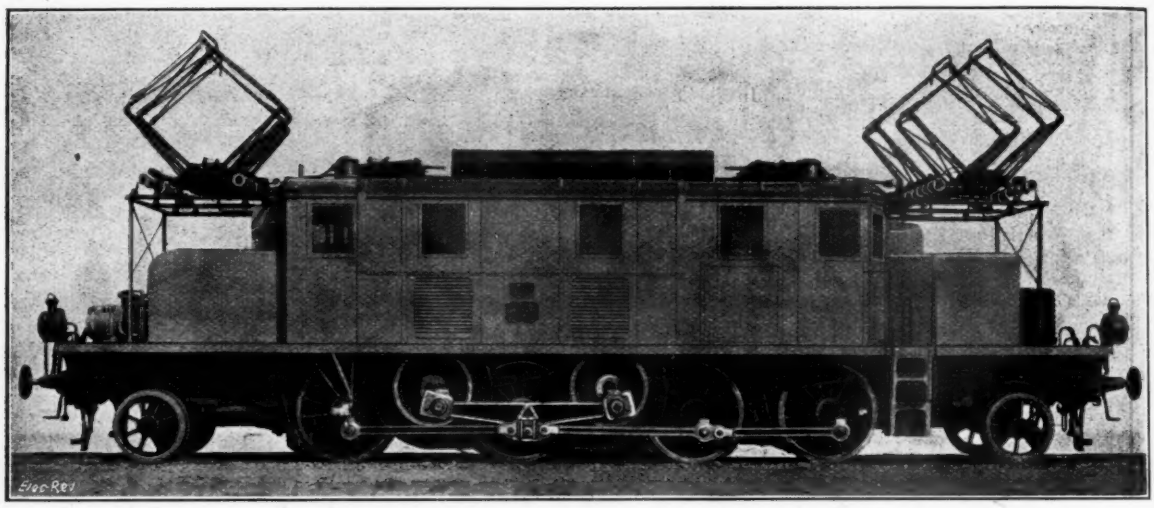


Fig. 18.—Breda Locomotive for Operating at 10,000 Volts, 45 Cycles.

Private Railways.

In addition to the State Railways, there are at present about 600 miles of private railway electrically operated, of which 130 miles are on the single-phase system, the remainder being direct current; some of these are light railways constructed somewhat on transatlantic lines; for example, the Rome-Frosinone and Frascati railway. The Turin Ceres branch, 27 miles long, is remarkable because 4,000 volts direct current is used on the motors, supplies being furnished from h.p. mains through Brown, Boveri rectifiers. An interesting high-speed line is that from Rome to Ostia, 15 miles long, which links a new watering place to the metropolis.

There is a private single-phase, single-line light railway from Terni to Umbertide and Perugeia, aggregating 70 miles; this passes through some romantic country in the centre of Italy. The line is supplied from industrial mains at 44 cycles, three-phase, through motor generators supplying single-phase current at 25 cycles, 11,000 volts. The trains are light, up to 140 tons for passengers, and up to 200 tons for goods; haulage is by means of auto-luggage vans with transformers and axle-hung motors.

In conclusion, the author must thank Senor Jacobini, of Rome, chief electrical engineer of the Italian State Railways, and the district engineers of Leghorn, Genoa and Turin and their staffs, and the locomotive superintendent of Bussolino, for the furnishing of much detailed practical information, for the supply of many photographs and drawings, and for their kindly hospitality during a visit to Italy. One was struck by the practical way in which many difficult problems were being handled, by the great increase in efficiency, and by the civic enthusiasm of those one came into contact with.

Voltage Regulation Systems.

A comparison of the various main methods of voltage regulation on alternating-current systems, and a detailed review of the possible methods of employing the tapped-transformer principle.

By G. RATTENBURY.

RECENT developments, particularly in connection with the national interconnection scheme, make opportune an examination of the relative merits of various possible systems of voltage regulation on alternating-current systems. Ignoring entirely the regulation of bus-bar voltage at the power station, which, on large modern systems and with interconnected power stations, is inadequate for maintaining the pressure within the Board of Trade limits at every part of the system, the following deals solely with the problems of correcting at or near the distributing points, voltage variations which may arise as a result of pressure drop in lines and transformers, and also of controlling the transmission of power between interconnected power stations or systems. Obviously there are two distinct problems; first, voltage regulation on small units of less than perhaps 200 or 500 kVA, where the secondary pressure will usually not exceed 500 volts, and where automatic control is frequently necessary to permit of the installation of the gear in unattended sub-stations, and,

secondly, the regulation of the transmission of power over large interconnectors, or the maintenance of the voltage of high-pressure bulk supplies for loads ranging up to 100,000 kVA (as projected for the national interlinking scheme). For the latter, manual operation by means of push buttons, or by some supervisory-control system, enabling the distribution of load to be under the intelligent control of the load dispatcher, is usually preferable to the purely mechanical control of automatic relays.

Of the three distinct types of apparatus which have been used for these purposes, the synchronous condenser (an over-excited alternator) has been used to a considerable extent in the United States, presumably because it was the most satisfactory system prior to the development of large tapped transformers with regulating switches. It gives automatic regulation without requiring relay control, but the use of rotating machinery is often objectionable, and the capital cost is high and the efficiency low. These objections are not serious when a mechanical load can be provided in addition to the electrical load, as in the case of motors driving continuously-running machinery, such as hydraulic pumps, fans, or even line shafting. Under these conditions the machine (a synchronous motor, preferably self-starting) is used rather for power-factor correction than for voltage regulation directly; but by reducing the wattless current it has the effect of assisting to maintain the supply voltage constant.

The induction regulator consists of windings on fixed and movable iron cores, and voltage regulation is effected by the angular displacement of one (the rotor) relatively to the other (the stator). The idea has been developed to a considerable extent, particularly for automatic voltage control on small feeders, but various difficulties arise in developing the design for large transmission schemes. Induction regulators have the advantages of eliminating switch contacts from the main circuits, and giving smooth voltage regulation. The latter is largely discounted by the fact that the regulation will necessarily be effected in steps depending, if manually controlled, on the minimum voltage readable on the instrument; and, if automatically controlled, on the minimum workable pressure variation on the voltage relay (about plus or minus 1 per cent. for instruments at present obtainable).

On the other hand, the efficiency and power factor are rather low, and the phase angle is altered by the movement of the regulator. This is unimportant on isolated feeders, but where parallel feeders, ring mains, or interconnectors are in use it has to be overcome by the use of twin regulators connected so that each one neutralises the phase shift of the other; this adds to the cost of the equipment and still further reduces the power factor and efficiency. Another disadvantage is that in the larger sizes it is difficult to provide sufficient mechanical strength to resist the mechanical stresses set up under short-circuit conditions in the rotor and stator, and also in the end connections and in the flexible connections to the rotor. Again, at higher voltages there are also difficulties in satisfactorily insulating the slots, and at transmission voltages above 11,000 additional static transformers are frequently introduced to safeguard the regulator from both electrical and mechanical stresses, thus further increasing the cost and reducing power factor and efficiency. Further, voltage surges may be produced in the windings by short circuits and interruptions of the current due to switching, and noise is difficult to eliminate and severe stresses may be produced at the moment of switching on.

These disadvantages are avoided by the third system of regulation, which utilises static transformers provided with tappings and connected to switchgear designed to permit of regulation under load. The use of tapped transformers to the best advantage requires careful consideration of the various possible methods of connection and the correct location of the switchgear to minimise the one disadvantage, *viz.*, that moving and contact-breaking parts are necessary. The regulating switchgear can be fixed either partly inside and partly outside the transformer tank, wholly outside the tank, or entirely separate from the transformer. The advantages of combining the switchgear with the transformer are that the cost and space required are both minimised, and that the connections between the switchgear and the transformer are completely enclosed and mainly or entirely submerged in oil.

The advantages of separating the switchgear from the transformer, however, are: the transformer is simplified, reduced in size (a matter of considerable importance in the case of the largest units), and natural cooling is unrestricted; removal of the transformer from the tank is not impeded by switchgear attached to the transformer or mounted on tank walls; emergency operation of transformers on a fixed tapping is possible by linking across suitable terminals; standardisation is facilitated and the design of the regulator is not restricted by the necessity of adapting it to the transformer; absence of working parts from the transformer tank obviates troubles due to parts coming loose or to metallic particles, produced by the frequent operation of tapping switches in a thin oil, being deposited on the insulation, so increasing the risk of breakdown and, perhaps, by their increased surface, the rate of sludging; and routine inspection and the renewal of all working parts are possible without opening up the main transformer, or, in those cases in which it is practicable to provide suitable isolating gear, without cutting off the supply. (See diagram of booster system with isolating gear, fig. 8.)

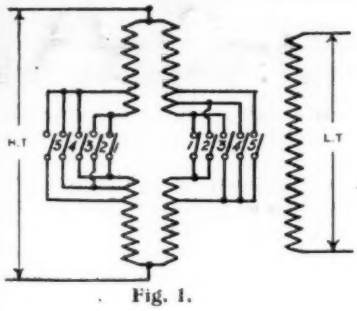


Fig. 1.

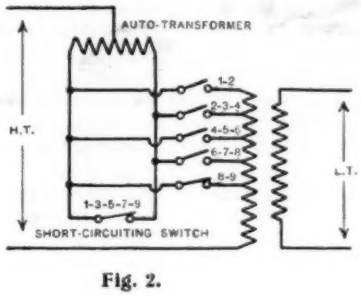


Fig. 2.

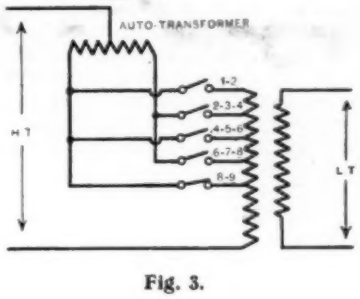


Fig. 3.

There are two possible methods of regulation, (*a*) by direct tappings on main transformers, or on auto-transformers if no main transformers are available for regulating purposes—typical arrangements are shown in figs. 1, 2, 3, and 4, and (*b*) the booster system, consisting, as shown in figs. 5, 6, and 7, of a boosting transformer connected in series with the supply and energised either from a tapped regulating winding on a separate shunt transformer, or forming a tertiary winding on the main transformer, or from an auto-transformer or other similar means.*

The advantages of direct tappings, as compared with the booster system, are that the floor space is reduced and the external connections are minimised, and the efficiency is slightly higher (by about 0.3 per cent.) and the capital cost is lower.

* Figs. 1 to 7 are shown single-phase for the sake of simplicity, but are equally applicable to three-phase systems. The figures against switches indicate circuits which are closed on successive steps.

The advantages of the booster system, however, may be summarised as follows:—

1. The main transformer is in its simplest possible form and has the fewest possible connections or encumbrances to hinder its removal from the tank.

2. The elimination of tappings and idle or open-ended windings prevents the possibilities of resonance, voltage surges, or reflected voltage waves.

3. The regulating switchgear is operated at the lowest possible voltage, regardless of the transmission pressure, to suit the switchgear and boosting transformers (direct tappings must nearly always be on the h.p. side to facilitate design difficulties).

4. The regulator is only called upon to handle the amount of boosted power, and not the total power transmitted.

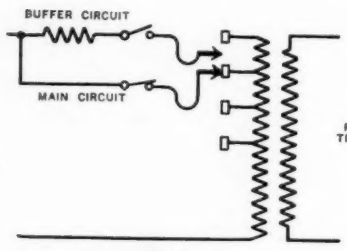


Fig. 4.

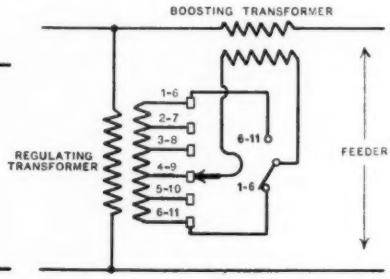


Fig. 5.

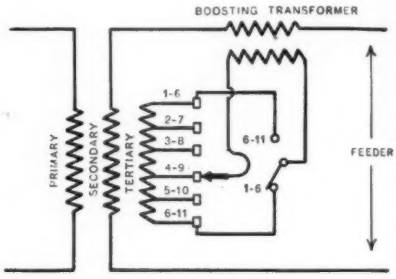


Fig. 6.

5. Magnetic balance of the main transformer is undisturbed, and it is possible to obtain balance on the tapped transformer.

6. The switchgear is shielded to a considerable extent by the reactance, and leakage of the boosting transformer from the effects of surges produced by switching, accidental short-circuits, or lightning effects.

7. The high-pressure side of the boosting transformer, consisting of comparatively few series turns, can readily be insulated between the turns to withstand transient pressures (steep wave fronts), and if connected on the line side will relieve the end turns of the main transformer from their effects.

8. Provision of spares is facilitated, the booster systems making possible the separation of the gear into units.

9. Modification in the amount, direction or coarseness of regulation, if necessitated by changes in load conditions, may be made easily without affecting the main transformer.

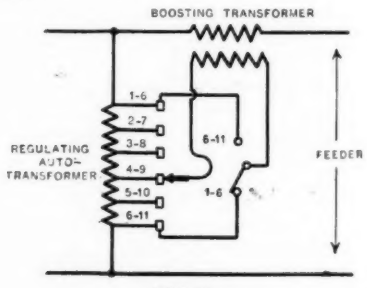


Fig. 7.

10. In emergency, main transformers can be used alone, boosting transformers being cut out of circuit.

11. Isolating gear can be provided for all vital parts external to the main transformer (see fig. 8).

12. It is adaptable to cases where main transformers are not required, and can be connected either on the h.p. or l.p. side of the transformer, whichever may be most favourable from the point of view of protection or insulation to earth.

For changing tappings under load without interrupting the main circuit, several devices are possible. The parallel winding system, one form of which is shown in fig. 1, involves the division of the main transformer winding into two parallel halves, each with adjusting tappings, which are open-circuited in turn, either (*a*) by an auxiliary switch, or (*b*) by the tapping switch itself, while the tapping is changed. No supplementary apparatus is necessary for changing the tappings, but there are the following objections:—Arrangement (*a*) usually necessitates the selector switch being inside the tank and attached to the main transformer, on account of the large number of tappings required to obtain a reasonable number of working steps. The objections to this policy have been already explained, and even with this arrangement it is necessary to bring more leads out of the tank than are required on a simple transformer. Arrangement (*b*) necessitates a large number of connections being brought out of the tank to obtain comparatively few regulating steps. Flicker or voltage surges may be caused during the change-over from one step to the next, when the whole of the current is carried momentarily on one half of the winding with correspondingly increased impedance; this is particularly objectionable on the smaller feeder regulators when they are automatically controlled. Reflected waves or voltage surges may possibly originate in the half of the winding which is open-circuited during the transition period. Transformer-design difficulties are increased, and additional insulation between the turns must be provided, on account of the necessity for providing sufficient reactance between the two half windings to reduce the circulating current in the transition position to a reasonable value.

The preventive auto-transformer or choking coil with mid-point tappings can be used in three different ways. Fig. 2 shows an arrangement in which it is used, not only to provide for the transition from one main step to another, but also to obtain intermediate steps between the tappings on the regulating transformer, the two ends of the auto-transformer being connected to the same tapping on the main steps, and to adjacent tappings on intermediate steps. This necessitates the auto-transformer being continuously rated both for half the full-load current in each half of the winding, and also for connecting continuously across any one of the transformer sections. Alternatively, if the additional steps are not required, the auto-transformer can be designed merely for carrying half the full-load current in each half of the winding. The connections of the switchgear would be the same, but the intermediate steps would be merely transition steps. In the third arrangement, fig. 3, the additional steps are obtained as in the first case, but the auto-transformer is designed for carrying the whole current continuously through half of the winding. This arrangement simplifies the switchgear, but makes the design of the auto-transformer a compromise, and also introduces a certain amount of

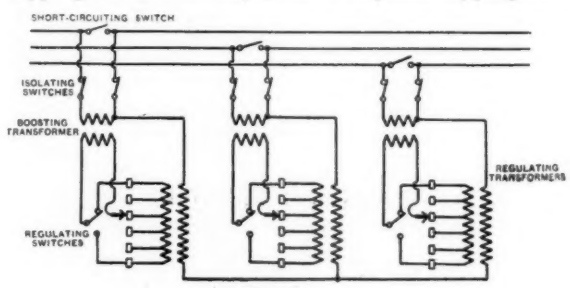


Fig. 8.

reactance permanently into the circuit in certain positions.

All preventive auto-transformer systems simplify the switchgear, and some increase the number of steps obtainable from a given number of sections on the regulating transformer. They have, however, the following objections:—

Fluctuation in voltage (sufficient if regulating steps are coarse to cause a flicker in lamps) is produced by the momentary insertion of a reactance in the circuit while changing from one tapping to the next; surges may also be caused by these fluctuations in voltage, and are the more probable if the direct system as distinct from the booster system of regulation is adopted; and a reactance permanently in circuit has obvious disadvantages.

The buffer-circuit system, connected as shown in fig. 4, with a resistance or choking coil in circuit during transition only, has the following advantages: the voltage will take an intermediate value in the transition position between steps, so reducing fluctuations; and oscillations can be almost entirely prevented, as proved by oscillograph tests, by using resistance in the buffer circuit.

To recapitulate:—

1. The synchronous condenser finds its application in industrial plants, for power-factor correction, where a suitable mechanical load is available for it to drive.

2. The induction regulator minimises switchgear and gives smooth regulation, but is not so easily made robust, mechanically and electrically, as the tapped transformer.

3. The tapped transformer is most suitable for transmission purposes generally, and its advantages are most completely realised by:—

(*a*) Separating the switchgear entirely from the transformer for simplicity of construction and ease of maintenance.

(*b*) Using the booster system particularly on e.h.p. and large power transmissions to simplify the main transformer and to reduce the capacity of switchgear, safeguard it against surges, facilitate maintenance and to increase the flexibility of the lay-out.

(*c*) Using a simple buffer circuit, preferably with non-inductive resistance, for changing the tappings.

Wireless Export Trade.

The British Position in International Competition.

By A. J. SMITH.

THE 1927 export statistics of the various countries producing wireless material show very clearly that British manufacturers will require to make increasing efforts in certain markets if this country is to secure a reasonable share of this new export industry. Hitherto, as a consequence both of the valuable start obtained through an earlier development of broadcasting as well as the advantages afforded to productive enterprise by the largest protected home market in the world, the United States has held the leading position, but in 1927 the highest figure ever reached by American exports was definitely passed by Germany, with a total just in excess of two million pounds sterling. The figures for the past few years for the three main producing countries, since the stabilisation of the German currency has made comparisons possible, are:—

	Great Britain.	Germany.	U.S.A.
	£	£	£
1923 ...	300,156	324,555	710,889
1924 ...	465,292	960,850	1,243,487
1925 ...	1,289,749	1,478,300	2,042,018
1926 ...	1,266,384	1,581,800	1,813,300
1927 ...	1,203,856	2,099,150	1,906,000

It is useful to examine these figures in a little more detail in the endeavour to ascertain where export enterprise needs strengthening.

German Trade Analysed.

The main German export markets are near home. Of the total wireless exports in 1927, about 82 per cent. went to European countries. The exports to the continent of America amounted to about 7 per cent., the United States taking about 4 per cent. and the Latin-American countries combined 3 per cent. German exports to British overseas countries have been comparatively trifling, although the Australian proportion of 37 metric tons was nearly double the quantity taken in 1926, and is likely to increase considerably. Outside the European trade, however, perhaps the most significant feature of the German radio industry is its ability to sell a steady proportion of its output in the United States, in spite of the strength of the local competition and the barrier of a high tariff. It is fairly clear that if German trade with the United States has increased to 4 per cent. of the total, the trifling 3 per cent. represented by exports to all the Latin-American countries combined is no fair measure of what is likely to be done in the future. All these countries have in the past drawn the major portion of their wireless supplies from the United States, and if Germany is becoming increasingly able to compete with the latter in the home market, it follows that it is only a matter of time before

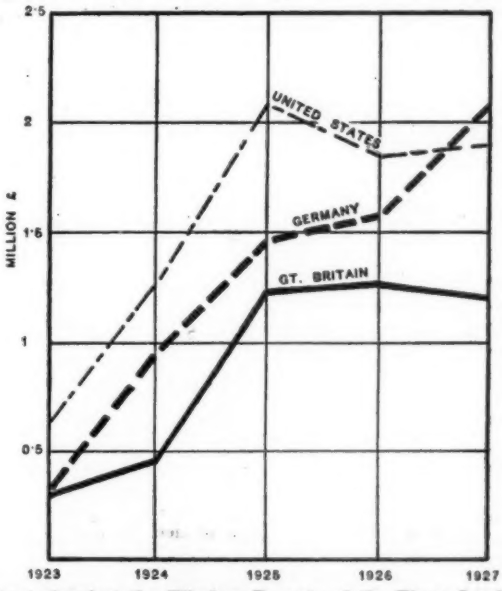


Chart showing the Wireless Exports of the Three Leading Countries.

she secures a much larger share of the South American trade to the detriment of American exports to the same destination.

At the time of writing, the detailed analysis of the countries of destination for U.S. exports has only been brought up to the end of 1926 but from these figures it can be seen that slightly over half the American exports have gone to countries in North and South America.

Canada has for some years been the largest export market, taking about one-third of the total. Shipments to Latin-American countries have represented about one-sixth of the total. Exports to Europe have been trifling, but in Australia taking an average over the past three years, they have been about equal to the British share.

The British position, as will be seen from the chart reproduced above, shows the need for increased efforts, as exports last year suffered a slight decline, and they made no real headway during the preceding year. An examination of the statistics for 1927 shows that about 42 per cent. went to the Dominions, this proportion being practically the same as for 1926. In all the countries of North-West Europe, British exports have decreased while the German shipments have increased. In the Netherlands, however, there has been a substantial increase, and the shipments to Latin countries, taken as a whole, show an improving position. The increase in exports to the United States is especially encouraging, although these are only approximately half the value of German shipments to the same destination.

In India, the first results of the opening of an organised broadcasting service in Calcutta and Bombay are to be seen in increased shipments amounting to £86,000 in round figures, which is nearly double the previous year's total. In Japan, we have increased our exports to £197,000, while German shipments have been practically halved. China is another Asiatic market which is taking more British wireless goods, while German trade has suffered a similar set-back as in Japan.

Trade with Australia unfortunately fell off in 1927, and in connection with this important market it has to be borne in mind that the heavy duty which has been voted upon imported valves as an aid to Australian local production will undoubtedly come into force during 1928, although it has been twice postponed, and this is likely to have an adverse effect upon British trade. Fortunately the New Zealand figure shows an encouraging increase of about one-third on the previous year. In the Transvaal also the reorganisation of the broadcasting service has resulted in increased business.

Central and South America offer possibilities which have as yet only been partially explored. British exports both to Argentina and Colombia show substantial increases, and German exports to these countries have also increased. In Brazil and Chile, both British and German trade has lost ground.

Taking export markets as a whole, it seems probable that the importance of the United States is likely to decline somewhat, but it will be replaced by more formidable German competition. The latter, however, is as yet comparatively trifling in the British Dominions, where U.S. exports are nearly everywhere challenged by growing British trade. The most interesting group of markets for radio trade development is undoubtedly the Latin-American countries, where (with the possible exception of Mexico) there seems to be no valid reason, given adequate preparation and intensive cultivation, why British wireless exports should not be developed to the point of at least equalling the American share. An equal advance has been made in other countries such as Australia and New Zealand, where two or three years ago the American wireless trade appeared to be very securely entrenched. The export position, in short, indicates the necessity both of periodical surveys and more intensive development work in countries which have been shown by experience in industries of longer establishment to offer valuable markets for British manufactures.

Status Inquiries.

Precautions against Bad Debts.—Saving Time and Money.

[Communicated.]

PERSONAL experience, as well as a careful study of the experience of others gathered from reports of meetings of creditors, legal proceedings, and the like, has led the writer to the conclusion that probably half the bad debts in the electrical or in any other trade could be avoided by strict adherence to a rule on the subject of adequate inquiries being made, not only in the case of new accounts but periodically in the case of existing customers. In theory, at any rate, it is probable that every supplier or manufacturer would agree as to the need for careful inquiries respecting the status of a new customer, but in actual practice this precaution is very often neglected, or in other instances, through motives of mistaken economy, the investigations are not carried far enough.

The Agent's Order.

One of the most common instances of neglect of inquiry precautions is when an order is received through a district agent or traveller. In a great many cases, the instructions are received by the manufacturers upon their own agent's order form, asking for goods to be supplied to the third party ordering. In such circumstances, it is surprising how frequently ordinary precautions are omitted. The reasoning is obscure, but it would probably be to the effect that the agent being on the spot is in the best position to know all about the financial standing of the customer from whom he has secured the order, and that if there were anything unsatisfactory about the position, the order would not have been transmitted, or else the principal would have been warned. Such procedure (or lack of it) may perhaps be followed safely in nineteen cases out of twenty, but the result of the twentieth transaction may be disastrous. A manufacturer's inquiries in such cases should be precisely the same as if the order had been received directly from the customer. The agent, it is true, may be on the spot, but it does not follow that he is invariably fully acquainted with the position of all the people with whom he may do business, and it should, in addition, be borne in mind that he has only a small commission at stake in such cases, and runs nothing like the risk which is shouldered by the actual supplier. A further failing is that when inquiries are made they are very often insufficient. In the case of a first order, the new customer may be asked to furnish references, as a result of which the supplier is referred to one or two other firms with which business has been done. In such cases it may be taken for granted, before any inquiry is made, that the information forthcoming will be satisfactory, or quite obviously the names would not have been quoted. Credit being the life-blood of commerce, it would be truly surprising if any trader, no matter how shaky his financial position, did not take particular care to ensure that his account with one or two suppliers was kept in excellent order, so that the latter could be quoted as references to other houses. A favourable answer therefore is by no means sound proof; when, however, the information obtained from such a source is *unfavourable* or evasive (as occasionally does happen), the verdict must be considered as particularly damning. Information obtained in this way is also subject to the further drawback that the firm named as reference may be equally as unknown as the new customer, and when this occurs, the reference should carry no weight whatever with a prudent supplier. Sufficient evidence comes to light regularly that the practice of people on the fringe of the industry coming to an arrangement to furnish mutually favourable reports and references is a very widespread one.

The Bank Reference.

A bank report is in a different category, as the standing of an English bank is beyond suspicion. Unfortunately, the average bank report is extremely guarded, and very little definite information is vouchsafed in the one or two dozen words comprising the usual report from such a source. A banking account, which from the bank's point of view is extremely satisfactory, may in actual fact represent money held in trust, or which may not be available for current trading needs. As a result of one of the most favourable bank reports which the writer ever encountered, he only narrowly escaped a bad debt of over £400. Fortunately the commencement of energetic legal proceedings in fairly good time enabled the debtor's banking account to be sequestrated (an effective method of embargo peculiar to Scots law) which proved sufficiently inconvenient to secure payment of a certain small portion of the account, and the return of the remainder of the goods. Personal investigation in the district and further inquiry of the bank agent (or manager) who furnished the original information, revealed the fact that at that time the account was a good one, and that the debtor had at his disposal ample funds for all commitments—a position which changed very suddenly with the withdrawal of certain financial backing. Other personal investigations revealed the fact that it was generally known in the district that the same debtor had previously served a term of imprisonment for obtaining goods on false pretences!

The Risk.

As showing the normal risks in trading, the following are figures furnished by Messrs. Stubbs, Ltd., relating to the total failures of individuals and firms in Great Britain during the last few years:—

	1925.	1926.	1927
Total failures	7,916	7,179	7,336
Total liabilities	£7,228,283	£5,366,766	£5,263,297
Total assets ...	£2,262,575	£2,271,323	£2,255,163

The foregoing returns are irrespective of limited liability companies. The latter, of course, form a peculiar class of risk for the manufacturer. Such a company, for instance, may have no more than £100 nominal capital; its assets may be more than covered by a debenture held by one or other of the directors or a relative. It is particularly difficult to bring any form of pressure upon such a concern when trouble arises, as whatever pressure or publicity is brought to bear, this hardly extends to the individual directors, and in fact in the case of a private arrangement or composition, the matter may never be heard of in ordinary trading channels outside the actual suppliers who have been hit by the failure.

The Easy Order.

Though every order should logically be followed by adequate investigation, inquiries need to be especially strict when the order is what is known as an "easy" one from an unknown source. In such a case, the writer's first care is to check carefully the figure which has been quoted to ascertain whether or not some error has been made in quoting the price, and if this is in order he sees to it that extra precautions are taken over the inquiries which are made. No manner of precaution can be an absolute guarantee against loss through bad debts or fraud, but the risk is greatly lessened if a rule is made to have the information obtained by means of references checked by independent inquiries through a recognised trade protection agency. The cost in such a case is about 2s. 6d. for each investigation, and in view of the fact that the inquiry need not be made in the majority of cases until after receipt of an order, it is hard to understand why such independent investigations are not invariably undertaken. The responsibility for ascertaining a customer's status is very often left to an order clerk, and in such cases it should invariably be made clear that the saving of half-a-crown is not a matter so much for praise as for censure.

Telegraphic Transmission.

Some suggested shore-end circuit arrangements calculated to bring about the elimination of disturbances in submarine telegraph cables.

By G. E. STEVENSON, A.M.I.E.E.

THE increased speeds obtained by the use of mechanical and electrical amplifiers, and the probable future development of these devices in submarine telegraph systems, have greatly emphasised the importance of eliminating extraneous disturbances, which definitely place a limit upon the speed of reception. These disturbances may be divided into three classes: those due to terrestrial causes or power distribution systems; those due to induced effects from other cables in the vicinity; and those due to unbalance of the artificial line.

The purpose of this article is principally to consider the disturbances due to the first two causes; as however the three causes outlined above are interconnected, it is impossible to neglect altogether consideration of the third.

It must be remembered that however complex it may appear, the terminal arrangement of a duplexed cable is that of the Wheatstone bridge, fig. 1, the arms X and R of which may be considered to be the cable and artificial line, consisting of a complex capacity-resistance structure; any current recorded in the G arm can only be caused by the absence of one of the two conditions necessary for balance, which are—

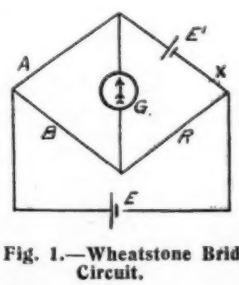


Fig. 1.—Wheatstone Bridge Circuit.

(1) The bridge must be completely balanced as regards the sending battery E by the fulfilment of the condition AR = BX. As is well known, a cable can be balanced at any single a.c. frequency by a simple π or T mesh. In practice the sending current wave comprises an infinite number of components of varying time constants, and a large number of meshes are required to obtain a balance; these are invariably arranged in series, and

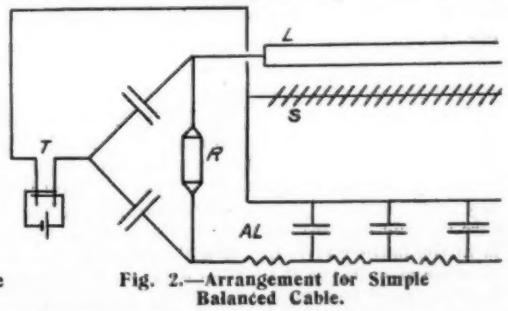


Fig. 2.—Arrangement for Simple Balanced Cable.

are designed to balance the distributed resistance and capacity of the line: A is always made equal to B.

(2) If an e.m.f. is set up in one arm of the bridge, it cannot be balanced out by any arrangement of the resistances forming the bridge, or by any arrangement of e.m.f. in the battery circuit. E in fig. 1 can only be

balanced out by a like e.m.f. in the arm BR, an opposing e.m.f. in the arm A, or by upsetting the condition AX = BR.

In the following diagrams, T represents the transmitting battery and key, L the line, S the sheathing, AL the artificial line, R the receiver, and EC the earth core. Fig. 2 shows the arrangement of a simple balanced cable. Although a perfect balance may be obtained between AL and the cable, any extraneous disturbance in the cable, in addition to the received signals, will be indicated on the receiver.

The first method of eliminating disturbances to be tried was the use of a twin-core cable on the shore-end, the second conductor being carried out to sea past the region where disturbances might reasonably be expected,

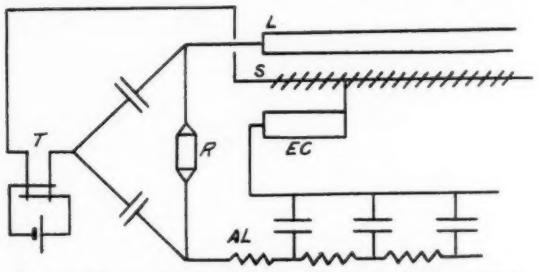


Fig. 3.—Connections for Twin-core Cable Arrangement.

and there earthed to the sheathing. The usual method of connecting this system up is to join the AL earth-plate to the core-earth and the sheathing to the earth side of the transmitting key, fig. 3. This method, while it effects a certain improvement, introduces a source of unbalance and does not completely eliminate disturbances. It will be seen from the diagram that a disturbance originating in the twin-core cable will set up an e.m.f. of equal amplitude and like sign in both cores. The earth-core is in series with the capacity mesh represented by the artificial line, whereas the cable side goes direct to the recorder arm, therefore the disturbances transmitted by those two arms are not equal, and show on the receiver. Also, the bridge is not balanced, due to the series-capacity effect on the artificial line side, which does not exist on the cable side. This arrangement will also cause disturbances to other circuits in the vicinity due to the different initial sending impedance of the two arms of the bridge causing an unbalance between the currents in the line and earth cores.

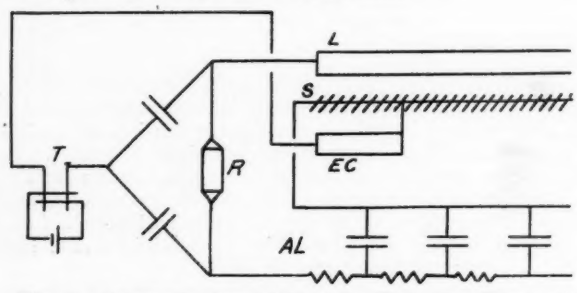


Fig. 4.—Alternative Arrangement for Twin-core Shore-end Cable.

Another possible arrangement of a twin-core shore-end is shown in fig. 4. This circuit is unbalanced because the twin-core beginning of the cable is not balanced on the artificial line side; this could be corrected by a suitable adjustment of the artificial line. In any case, however, the e.m.f.'s induced in the earth-core will not balance out those in the cable, as the former is in the battery circuit. It will also cause disturbance to other circuits, as the return currents from both cable and artificial line flow through the earth-core and are not symmetrical with the current in the line.

In order to correct the known imperfections of the twin-core shore-end, arrangements of three cores have been tried, but these have not hitherto fulfilled the principles outlined above, which must be done in order to ensure perfect freedom from interference. A diagram of one usual arrangement is given in fig. 5, which shows the use of two earth-cores of different lengths, the longer one being connected to the earth plate of the artificial line, and the other to the key earth. With this arrangement, even were the two earth-cores terminated at the same place, there would be an unbalance between the two earth paths. The cable is a pure twin core up to this point, the artificial line a single core with added resist-

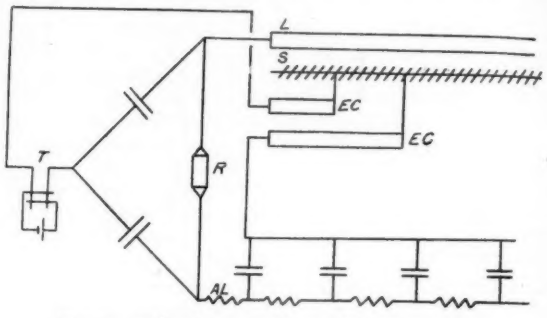


Fig. 5.—Circuit Connections with Three Cores.

ance and slight capacity effect in the earth path. It will also be affected by disturbances in the same way as fig. 3, as the key earth-core, being in the battery circuit, plays absolutely no part in eliminating these.

From the foregoing it will be seen that no system of terminating a duplexed cable has yet been devised which will completely eliminate earth disturbances. In view of the improvement that would be effected by an

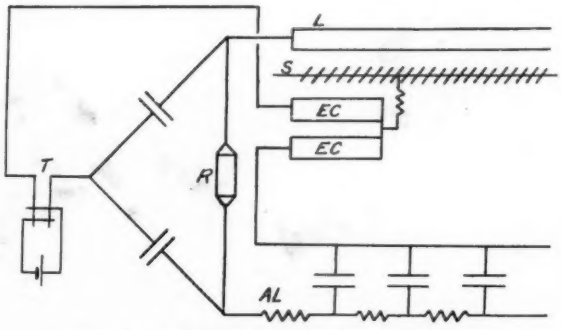


Fig. 6.—Variation in Three-core Arrangement.

arrangement which would do this the following suggestions are made.

Fig. 6 shows an arrangement using a variation of the conventional tri-core shore-end. The resistance between the termination of the earth-cores and the sheathing is made equal to the resistance of the artificial line earth, and balances the two earth systems—earth-core to earth plate of artificial line, and equivalent resistance and sheathing.

In fig. 7 is shown an arrangement which has not yet been tried for the purpose, but which will, it is

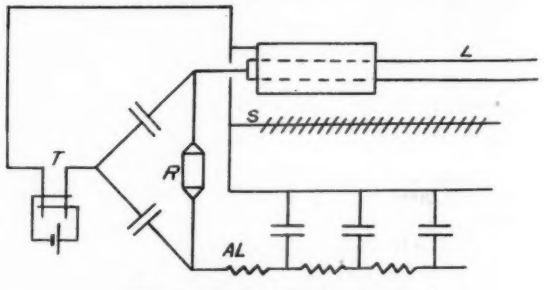


Fig. 7.—Concentric Shore-end.

claimed, entirely fulfil the required conditions, in addition to forming a very much lighter and more efficient form of sea-earth than any of the types mentioned above. The shore-end of the cable consists simply of a length of single-core cable surrounded over its dielectric by a

complete metallic sheath which is in turn insulated. In other words, it is a concentric cable carried out to sea as far as is considered necessary, whose outer conductor is insulated at its far end and joined at the sending end to key and sheathing earth.

It is well known that there is no electric force inside a hollow conductor carrying a charge; any e.m.f. therefore induced in the outer conductor flows to earth without in any way affecting the signalling conductor. With this arrangement, therefore, any disturbing e.m.f. within the length of cable composed by the concentric core will set up a current in the outer conductor only, the inner being effectively screened. At the same time, the sending-end conditions will be stable.

Extensions at Doncaster.

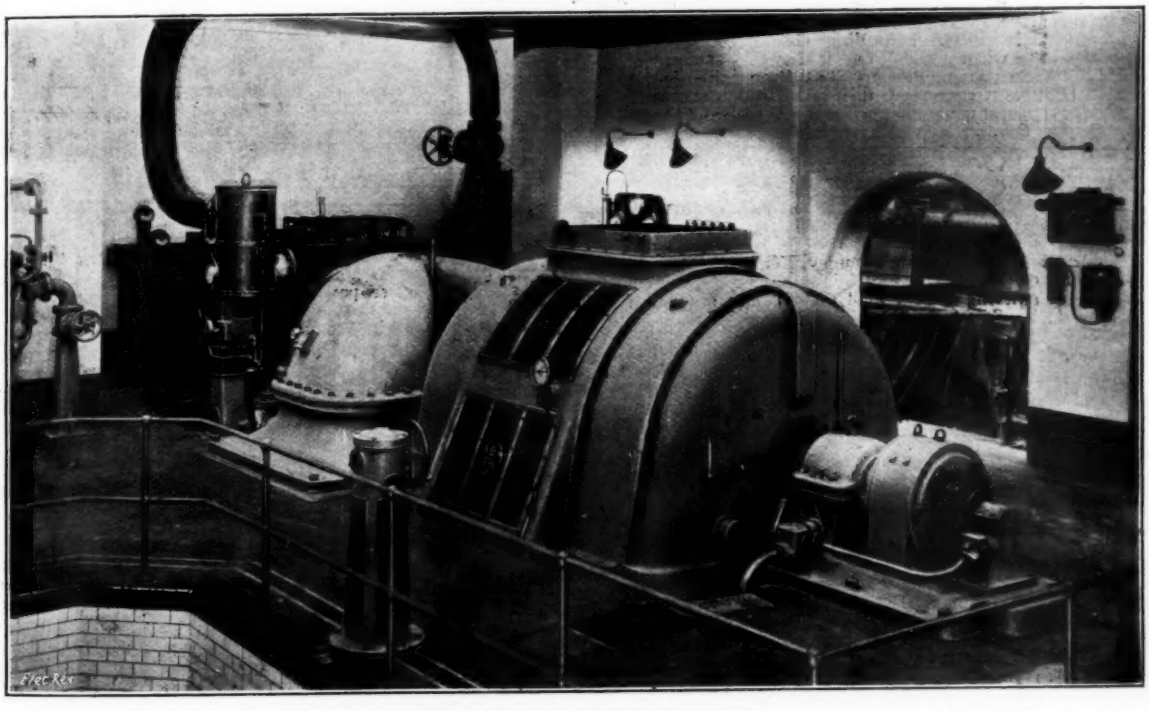
The recently inaugurated extensions at the Corporation Electricity Works include a 7,500-kW turbo-alternator and auxiliaries.

ON March 29th the Mayor of Doncaster, Councillor H. Warren, formally inaugurated the latest extensions at the Corporation electricity works, which consist of a new 7,500-kW turbo-alternator, shown in the accompanying illustration, manufactured by the British Thomson-Houston Co., Ltd., with the necessary auxiliaries. The space available for the machine was very restricted, but, notwithstanding difficulties experienced in connection with the lay-out, arrangements have been made so that easy accessibility is a notable feature. The turbine is a 10-stage machine running at a normal speed of 3,000 r.p.m. It is designed for a steam pressure at the stop valve of 200 lb. per sq. in. gauge, with a final temperature of 550 deg. F. and a vacuum of 28.5 in. of mercury. The alternator, which is directly coupled to the turbine, has a continuous maximum rating of 9,375 kVA at 80 per cent. power factor, 3,200-3,500 volts, three-phase, 50 cycles. An interesting point in connection with the generator is that the rotor is built up on a solid forging. Effective cooling of the alternator is obtained by means of the B.T.-H. patented enclosed air-cooling system, and the exciter is directly coupled to the alternator shaft.

The governing characteristics provide for a momentary speed variation not exceeding 5 per cent., with a permanent variation of 2.5 per cent., when a load corresponding to the service rating of 6,000 kW is suddenly thrown on or off. With a load variation of 10 per cent. up or down, the momentary speed variation is only 0.5 per cent., and the permanent variation approximately 0.25 per cent. Two duplicate Tirrill voltage regulators maintain the correct busbar pressure.

The condensing plant is of Messrs. Mirrlees-Watson's surface type, and provides maximum de-aeration of the condensate before it leaves the condenser shell. The temperature drop between the exhaust and condensate is maintained within two or three deg. F. under varying load conditions. The condensate and circulating pumps are in duplicate, each being driven by a 400-volt, three-phase, 50-cycle B.T.-H. induction motor.

Following the opening ceremony and an inspection of the works, the visitors present were entertained to tea at the Doncaster Mansion House by the Electricity Committee, when Councillor H. M. Marshall (chairman of the committee) referred to the recent departure from Doncaster of ex-Alderman E. J. Dowson, the former chairman of the Electricity Committee, who had gone to London to take up an appointment with the British Electrical Development Association. He also referred to the pending move of the Doncaster borough electrical engineer, Mr. S. R. Windle, who is to take up an appointment at Grimsby. He mentioned that when Mr. Windle came to Doncaster, the annual output of the Corporation electricity works was 3,200,000 units. Last year the figure was 7,850,000. Notwithstanding this great increase, Mr. Windle's economies had led to an actual decrease in fuel consumption from 10,493 tons to 10,425 tons per annum in that period.



New 7,500-kW Turbo-alternator at Doncaster.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations and Failures.

Vickers, Ltd., and the Electrical Industry.

Speaking at last week's annual meeting of Vickers, Ltd., the chairman (Gen. Sir H. A. Lawrence), after referring to the general business of the company, said that W. T. Glover and Co., Ltd., had had another good year and had paid the same dividend as in 1926. He then mentioned the disposal of the company's controlling interest in the Metropolitan-Vickers Electrical Co., Ltd. Last year he had given it as his opinion that the electrical industry offered good opportunities for development, but it was one which was highly specialised and had nothing in common, from the control point of view, with the main business of the company. "We hoped that an amalgamation of electrical manufacturing interests would be effected so that we could exchange our holding for shares in a combine, but participation in such a scheme was not found practicable. When, therefore, we received a cash offer, as the price we could obtain showed a very substantial surplus on the cost of the shares, we decided to accept the offer, retaining, however, a large block of ordinary shares, so that, in the event of development eventuating on the lines indicated, we should receive an additional benefit therefrom. It is also understood that we shall be allowed to participate, if we so desire, in any new issue of capital which may be made. We stipulated that any new company formed to take over the shares should be an English company, and that our past arrangements for reciprocal trading should continue. The time may come when we shall find it desirable to invest more capital in the electrical industry, but I am convinced that, so far as Vickers is concerned, their participation should be in the form of investment only, without any desire to exercise control over a business which is foreign to their normal activities."

The Metal Trades Benevolent Society.

The Royal Metal Trades Pension and Benevolent Society announces that the second annual golf competition for the President's silver challenge cup will be held on May 16th, at Sundridge Park Golf Club, Bromley, Kent. All subscribers and donors of the Society are eligible to compete, and those desirous of entering should send their names and entrance fee (10s.) to the Secretary, 195, Upper Thames Street.

Local Exhibitions.

Inverness.—An comprehensive display of domestic, industrial and commercial lighting equipment was exhibited by the British Thomson-Houston Co., Ltd., at a recent electrical exhibition in Inverness. In addition, there was a variety of other "B.T.-H." products, as well as a complete range of "Hotpoint" electrical appliances. The domestic fittings included an extensive range of types and designs, together with a wide selection of glassware and silk and parchment shades. The "Hotpoint" appliances consisted of cooking apparatus of every description, electric fires including the new "Livecoal" models, "Duplex-Premier" vacuum cleaners, and a number of other domestic electrical appliances. The industrial and commercial lighting equipment comprised "X-ray" reflectors, totally-enclosed fittings, "Mazdalux" reflectors, and floodlight and spotlight projectors. "Tungar" battery chargers, fractional h.p. motors, starting panels, and "Fabroil" pinions were also shown.

A similar display was arranged by the company at an Aberdeen electrical exhibition.

Afghan King at the Met.-Vick Works.

Last week the King of Afghanistan paid a visit to the Trafford Park works of the Metropolitan-Vickers Electrical Co., Ltd., being conducted by Sir Philip Nash (chairman) and other officials of the company.

Electrical Material for Spain.

Electrical material is included in the list lately published by the Spanish Council of Ministers of articles and material that may be purchased abroad by Spanish Government Departments during 1928 without preference to offers from home manufacturers.

Canadian Specifications.

The Department of Overseas Trade has received copies of the specifications issued by the Canadian Engineering Standards Association for single-phase distribution transformers, and watt-hour meters. The specifications are available for loan to firms interested in the sale of such apparatus of United Kingdom manufacture.

Australian Tariff Amendment.

Among the amendments to the Australian tariff embodied in an Act recently passed by the Commonwealth Legislature is an alteration in duties on "wireless sets; headphones." The new rates are:—British preferential, 35 per cent. *ad valorem;* intermediate, 50 per cent.; and general, 55 per cent. (*vide Board of Trade Journal*).

The North-East Coast Exhibition.

An Exhibition of Industry, Science and Art is being organised to take place in Newcastle-upon-Tyne from May to October next year. His Majesty the King is patron of the exhibition, and the names set out in a preliminary prospectus which we have received are a guarantee of its importance and representative character. The display will occupy an area of about 100 acres, and specially-designed buildings are being erected for the exhibits. The latter will be essentially British, and home and Dominion manufacturers and others are being invited to participate. There will be eighteen main sections, and among them will be electrical engineering, lighting, heating, cooking, ventilation, refrigeration and laundry equipment; road transport and motive power; science and education; and advertising and business efficiency appliances. The general manager of the Exhibition is Mr. C. P. Hainsworth, Exhibition Offices, Pearl Buildings, Northumberland Street, Newcastle-upon-Tyne.

Conditions in Persia.

A report upon the finance and commerce of Persia has been prepared by Mr. E. R. Lingeman, Acting Secretary in Charge of Commercial Affairs, Teheran, and published by the Department of Overseas Trade (Stationery Office, 1s. 6d. net). In the course of this it is stated that only the towns of Teheran, Bushire, Tabriz, Resht, and Enzeli have electric light. The plants are mostly unsatisfactory owing to their small size, and lack of supervision, spares and funds. A wiring concession has been granted for Isfahan, and others are in course of negotiation for Sultanabad, Kermanshah, and other towns. Electricity has so far not been used in industry. The potential supply of water power is relatively small, although it would probably meet the needs of most Persian towns for some time to come. Mr. Lingeman says that Persia offers a progressive market for a number of classes of goods, including electrical plant. He also states, however, that the market is a poor one, and, on the whole, unreceptive to high-quality and high-priced British goods.

French Duties on Meters.

The duties on meters, including electrical patterns, upon importation into France are shortly to be fixed at 28 fr. each for meters weighing under 5 kg., and 5 fr. per kg. for those over 5 kg.

Recent Contracts.

Messrs. Davey, Paxman & Co., Ltd., inform us that as a result of their exhibit at the British Industries Fair, Birmingham, they have received an order from the Ashford (Kent) U.D.C. for the largest airless injection Diesel engine to be put down in this country for power station use. It will be capable of developing up to 1,070 b.h.p. The fuel oil is injected mechanically on the company's patent "spring injection" system introduced a few years ago. Amongst other orders placed as a direct result of the Fair is one from the Llandrindod Wells U.D.C. for a 300-b.h.p. engine. The company reports that the business done at the Fair far exceeded expectations.

Messrs. R. Brooks & Co. have placed an order with Petters, Ltd., Ipswich, for two 125-kW, 440-V, 3-wire generating sets, incorporating 187.5-b.h.p. engines direct coupled to G.E.C. generators. These sets are to be installed at the Colombo Turf Club for lighting and power purposes.

Social Event.

The staff of the Automatic Telephone Manufacturing Co., Ltd., held their fifth annual dinner on March 23rd, at the Exchange Hotel, Liverpool. The chair was occupied by Mr. J. Lee, C.B.E., late Controller of the Central Telegraph Office, London. The toast of "The Company" was proposed by Sir Max Muspratt, Bt., Mr. John Lee responding. "Our Guests," proposed by Mr. G. W. Moore, and acknowledged by Mr. Powell-Jones, secretary of the Telephone Development Association, completed the toasts. An excellent concert followed, the artistes being Miss Gladys Simcoe, Miss Elsie Winnall, Pursall and Stanbury, and Mr. Eric Child. Pennington's Quartette provided musical selections during dinner.

The World's Electric Fan Trade.

Commerce Reports states that the international trade in electric fans, which in 1927 amounted to about $5,000,000 (£1,000,000), is easily dominated by the United Kingdom, the United States, Italy, and Germany, whose respective shares in the year mentioned were 35, 25, 20, and 10 per cent. United States exports to this country, although already insignificant in amount, show a tendency to decline from year to year as British manufacturers urge more widespread use of British-made articles.

Catalogues Wanted.

Messrs. C. G. Pursey & Sons, electrical engineers and contractors, of 63, Beulah Road, Tunbridge Wells, wish to receive priced catalogues from suppliers of lighting, heating, and cooking apparatus.

Burndept Wireless, Ltd.

At a meeting of creditors on Monday last approval was given to a scheme for raising £90,000 of new capital, paying off the debentures, and giving creditors 6 per cent. unsecured 10-year notes at the rate of 10s. per £ on the amounts due to them. In introducing the scheme, Mr. C. W. Rooke, receiver for the debenture-holders, said that the prospects of the company were very good and a considerable export trade was being done. The passing of the scheme would give the company about £150,000 of free assets and a working capital of about £10,000. A committee was appointed consisting of representatives of the Marconi Company, Siemens Bros. & Co., Ltd., the Dubilier Condenser Co., Ltd., and the Old Ford Engineering Co.

Unemployment.

The total number of registered unemployed on March 19th was 1,066,100. This represented a decrease of 5,630 during the week and was 12,450 less than on March 21st, 1927.

Trade Announcements.

Messrs. Eric J. Lever (Trix), Ltd., have removed to 8 and 9, Clerkenwell Green, London, E.C.1.

It is announced that the electrical and wireless business of W. Saunders, Ltd., of 26-28, Crouch Street, Colchester, will in future be carried on by the late managing director of the firm, Mr. P. W. Olle, who has leased the premises.

Mr. H. Wigger, at one time sales manager of Messrs. H. Braden, Ltd., and latterly a representative for Messrs. Siemens, Schuckert (Great Britain), Ltd., has joined Messrs. Brandes, Ltd., as representative.

The telegraphic address of the Ipswich branch of the General Electric Co., Ltd., has been changed to "Electricity, Ipswich," and that of the Belfast branch to "Electricity, Belfast."

Mr. J. Slater, electrical and radio engineer, has opened new premises in King Street, Blackburn.

Mr. Zelley, a London representative of Messrs. L. G. Hawkins & Co., Ltd., has been appointed manager of the "Duplexalite" department of that company, and Mr. Last, who has been with the company for many years, is taking care of the territory previously handled by Mr. Zelley. Mr. G. C. Phelps (late of Messrs. J. & W. B. Smith, Ltd.), has been appointed special sales representative for the South Coast and district.

New Catalogues and Lists.

The Clarkson Thimble Tube Boiler Co., Ltd., 613, Australia House, Strand, W.C.2.—A folder containing a number of illustrated pamphlets describing various forms of "Clarkson" boilers, with particular reference to their use in the recovery of waste heat. Also a booklet giving illustrated details of the electric lighting sets produced by the Austin Lighting Co., whose business has recently been acquired.

The General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—Booklet 4624, containing illustrated information regarding the company's export organisation, which was described in our issue of January 28th, 1927.

The Tudor Accumulator Co., Ltd., 2, Norfolk Street, Strand, W.C.2.—Two coloured showcards advertising the company's accumulators for radio and automobile purposes.

The Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.—A coloured poster illustrating the new "WH.10" large-capacity high-tension accumulator battery for radio work. Priced.

Petters, Ltd., Westland Works, Yeovil.—A well-illustrated publication dealing with various patterns of the company's generating sets for kinema lighting and power.

Messrs. F. Thomas & Co., Ltd., 189 and 191, Drummond Street, N.W.1.—A 77-page catalogue of electroliers, standards, brackets, bowls, pendants, and other lighting fittings; and two smaller lists dealing respectively with "Efteelite" unit fittings and alabaster bowl fittings. All three publications are well illustrated and contain prices.

Messrs. Verdon Cutts & Co., Ltd., 87, Fargate, Sheffield.—A pamphlet containing information regarding the company's electric furnaces for the heat treatment of steels and other metals.

Pullar's Electric Signs, 55a, Hollingbury Road, Brighton.—A pamphlet containing illustrations and prices of "Peco" British decorative glassware for electric lighting.

The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, W.1.—A striking coloured showcard advertising "Marconiphone" h.t. radio batteries.

The Jackson Electric Stove Co., Ltd., 143, Sloane Street, S.W.1.—An April calendar blotter bearing illustrations and the price of the "Atom" electric fire.

Company Liquidations.

Wareham Electric Supply Co., Ltd., 4, Great St. Thomas Apostle, E.C.—Mr. H. E. Burgess, Senior Official Receiver, and liquidator of the company, states that although the compulsory winding up order was made in April, 1927, no statement of the company's affairs has yet been submitted. The default has been reported to the Court, and proceedings instituted against certain of the directors, but it is considered unlikely that the statement when lodged will reflect the true position of the company. No accurate and proper books have been kept. There are misleading statements and material omissions in the company's statutory returns. The company was incorporated in October, 1920, with an original nominal capital of £5,000 (afterwards increased) to provide electricity in the borough of Wareham and adjacent parishes. From the end of May, 1923, the company became active, Edward Octavius Eaton, who had then just purchased the whole of the issued capital, entirely controlling its transactions and affairs, although he was not recorded as an officer. He had conducted a continuous campaign of selling capital on the pretence that it was a large and active business. Registered offices were taken at Bournemouth. There were also London offices where the company was housed with other concerns, in particular the Electricity Finance Distribution Corporation, Ltd., and the Lighting and Power Finance Corporation, Ltd. Those concerns had, to some extent, directors in common with the company, and were in effect names of Eaton. Between June, 1923, and March, 1926, there was issued to the public a constant stream of prospectuses, circular letters and documents, which generally in the name E.F.D. Corporation offered Eaton's "promoter's" shares and debentures and portions of the company's unissued capital for sale. These "prospectuses" contained unwarrantable promises and "puffs," and they succeeded in inducing small investors to subscribe £27,144. Because of the statutory restrictions the area of supply could not be developed to make a net profit of more than £400 per annum, *i.e.*, approximately enough to pay the debenture interest. The larger part of the subscriptions was paid over by the company to Eaton and to the E.F.D. Corporation. Mr. Burgess says that it is not possible within the scope of the report to give the full extent of the irregularities in the conduct of the company's affairs. The business of the company, if capitalised at a figure of about £5,000, and economically worked, could have been profitable. But in the hands of Eaton it was merely a medium for obtaining moneys from the public for his own benefit and the furtherance of his other schemes. So far as they were known, the liabilities amounted to £8,995. The Official Receiver has arranged for the sale of the company as a going concern, on valuation, for £2,500. The purchaser has, however, to obtain a Statutory Order, and completion cannot take place for several months. It is anticipated that the realisation in the liquidation, after payment of costs and expenses, will provide a dividend only to the holders of valid debentures. The total deficiency to creditors and shareholders will be approximately £30,000.

Notable Electric Co., Ltd., manufacturers of and dealers in electric lamps, 21, Waterloo Road, S.E.—Under the winding up order made against this company the Official Receiver has issued a statement of affairs showing liabilities of £2,279, assets *nil*, and a total deficiency of £7,279 with regard to the shareholders. In his observations the Official Receiver reports that the company was registered as a private company in 1916 with an original nominal capital of £100, divided into ordinary shares of £1 each. In 1917 the nominal capital was increased to £5,000. The objects of the company were to acquire and take over as a going concern a business carried on under the style of the Notable Electric Co., and to carry on business as manufacturers of and dealers in electric lamps, &c. W. J. Owen and F. Warner were the promoters. The shares appear to have been issued as follows:—Two signatory shares for cash, 98 shares to Warner in consideration of cash advanced and goods supplied, and 4,900 shares to Warner and Fennell in consideration of the purchase price of factory equipment, machinery and stock, &c., taken over by the company. In 1916 debentures for £1,000 were created, secured by a floating charge on the company's property and assets. £150 thereof were issued to Miss Fennell in consideration of cash advanced. In 1917 further debentures for £2,000 were created. The whole of the debentures created, except the first £150 held by Miss Fennell, were issued from time to time to Warner in consideration of moneys advanced by him, and the guarantee by him of a bank overdraft. The business was carried on at a loss throughout, due to heavy overhead charges, keen competition, litigation regarding infringement of lamp patents, &c. In 1925 the company disposed of its business to the Nelson Electric Co., Ltd., and under the same agreement Warner sold certain patent rights relating to a valve. The consideration for the sale was £2,000 in cash to Warner, and £7,500 in fully-paid shares. The company's liabilities to trade creditors were discharged with certain exceptions. After the sale the business practically ceased. In the opinion of the Official Receiver the failure is attributable to mismanagement in that no provision was made for adequate working capital.

D. M., Ltd., radio manufacturers and engineers, 125, Rosebery Avenue, E.C.1.—A meeting of creditors was held on March 27th, Mr. R. A. Bishop, 50-51, High Holborn, W.C., the liquidator, presiding. The statement of affairs presented showed liabilities of £1,214 and net assets of £425, leaving a

deficiency as regarded the creditors of £789. As regarded the shareholders, there was a deficiency of £5,789. Mr. Bishop stated that a large percentage of the stock consisted of items specially made in connection with a contract for the manufacture of a patent "all-wave" tuning instrument. The contract had been cancelled, and a proportion of the stock could only be regarded as scrap. The company was registered on July 7th, 1926, with a nominal capital of £7,500, to carry on business as wireless engineers and manufacturers of wireless sets and components, and entered into an agreement with the receiver for the debenture holders of the International Wireless Manufacturers, Ltd. Apparently the company acquired the business of that company for £3,500 in cash. During the period ended July, 1927, the sales were £6,003, with a gross profit of £1,758, and a net loss of £267. Since July of last year the sales had totalled £3,691, with a gross loss of £254, and a net loss of £1,352. Mr. Bishop stated that the loss was the result of the cancellation of the contract for the manufacture of the "all-wave" tuning instrument. The contract was cancelled owing to default in deliveries and faults in manufacture. On February 29th last a conference of the principal creditors was held, when it was suggested that an offer might be submitted. The meeting was adjourned for a week, but creditors began to press, and voluntary liquidation took place. A resolution was unanimously passed confirming the voluntary liquidation of the company, with Mr. Bishop as liquidator, and an informal committee was appointed consisting of the representatives of Messrs. Smith & Sons and the Trelleborg Ebonite Works, Ltd. The following are creditors:—

	£		£
British Ebonite Co. ...	42	Goswell Plating Co. ...	44
Bevir, N.	55	Hawkers, Ltd.	83
Barber, Ewbank & Co.	26	North British Mouldings	21
Crystalate Manufacturing Co.	115	Standard Insulator Co.	44
Castle, T. L.	82	Smith & Sons	215
Concordia Electric Wire Co., Ltd.	35	Standard Metal Co. ...	20
County of London Electric Supply Co., Ltd. ...	44	Stockall, Marples & Co., Ltd.	73
Every & Sons	61	Righton, H., & Co., Ltd.	57
Farmer, Stedall & Co.	41	Trelleborg Ebonite Works, Ltd.	112

THOMAS GUNN, LTD., late 30, Fore Street, E.C.2, and other addresses.—Mr. W. A. J. Osborne, one of the liquidators, states that the receiver continued trading, and eventually disposed of the business as a going concern at a very satisfactory price. The sale was approved by the creditors' committee. The receiver has discharged the debenture holders' claims and his personal liabilities as regards new goods and preferential claims. It has been decided to make a first distribution of 4s. in the £ to all creditors whose claims have been agreed.

MACOS BATTERY MANUFACTURING CO., LTD.—A meeting of members is called for May 5th at 122-3, Moorgate Station Chambers, E.C., to hear an account of the winding up from the liquidator, Mr. R. H. Dutchman.

MOULDENSITE, LTD.—Winding up voluntarily, for the purpose of amalgamation with Bakelite, Ltd. Liquidator, Mr. W. E. Cooper, 68, Victoria Street, S.W. Particulars of claims to the liquidator by April 13th.

ELECTRICAL SUNLIGHT & BERGONIE CO., LTD.—Winding up voluntarily. Liquidator, Mr. H. C. Field, Forge Cottage, Kneller Road, Twickenham.

STEVENAGE ELECTRIC LIGHT & POWER CO., LTD.—A meeting of members is called for May 1st, at Broadway Buildings, Broadway, Westminster, S.W., to hear an account of the winding up from the liquidator, Mr. J. J. Gibbons.

Bankruptcy Proceedings.

J. St. V. C. M. FARRANT, 14, Queen Victoria Street, E.C.4.—This debtor, who had been interested in the importation of pocket electrical batteries from America, was adjudged a bankrupt in 1922, came before Mr. Registrar Warmington in the London Bankruptcy Court on March 28th on the adjourned hearing of his application for an order of discharge. The Official Receiver reported that the debtor was formerly employed as an electrical engineer in many parts of the world. In 1917 he entered into a contract to buy from New York firms through the River Plate Commercial Company of London, 15 million electrical pocket batteries at 6s. per doz. Nearly one million had been shipped to him for which he had made payments by eight drafts when further imports were stopped by the Government owing to freights being reserved for munitions from America. Of the batteries which he received about one half proved faulty and he was compelled to repay the purchasers. He began proceedings in London against the vendors and at the end of two years succeeded in recovering £8,500, which all went in paying debts. The debtor estimated his total loss on the transaction at £4,000 or £5,000. The proofs of debt and probable claims together amounted to £11,685. The assets were valued by the debtor at £54,486, but they proved wholly irrecoverable. The trustee in bankruptcy had, however, received £800 from commission due to the debtor and a dividend of 1d. to 2d. in the £ was anticipated. His Honour suspended the discharge for 12 months.

H. N. SHORROCK, electrical engineer, 79, Granville Road, Morecambe, Lancs.—The public examination of this debtor was held recently at Preston. The statement of affairs disclosed liabilities of £470, with a deficiency of £285. Debtor first became aware of his position in June, 1924. His father purchased the business in August, 1921, as a going concern, for £590, and gave it to the debtor, who carried on until May, 1923, in his own name and without a partner. In that month the business was formed into a private company with a nominal capital of £2,000. Only 1,325 shares were issued, 800 to the debtor as fully paid for the business and others to other people for cash. The company carried on until December, 1923, when it was decided to wind up voluntarily and a dividend of 8s. 5d. was paid to the creditors, there being nothing for shareholders. In May, 1927, debtor again commenced business on his own account with £3 capital. The business was not successful owing to heavy overhead charges and the high cost of advertising. The examination was adjourned.

C. L. WEEKS, trading as Claude L. Weeks & Co., 27a, Charles Street, Newport, Mon., electrical engineer.—The first meeting of creditors was held at Cardiff recently. The liabilities were put down at £236, against assets of £23, leaving a deficiency of £213. Debtor attributed his failure to lack of capital and depression in trade. The Official Receiver was appointed to act as trustee of the estate.

R. HILTON, electrical engineer, 81, Blackburn Street, Radcliffe.—First meeting held April 3rd at the Official Receiver's offices, Byrom Street, Manchester. Public examination, May 8th, at the Court House, Bolton.

G. DODD, wireless dealer, &c., The Arches and Radcliffe Road, Crimble, Golcar.—First meeting, April 5th, at the Official Receiver's office, 12, Duke Street, Bradford. Public examination, May 9th, at the County Court House, Queen Street, Huddersfield.

F. H. BARRELL (F. H. Barrell & Co.), electrical and radio engineer, &c., 2a, 2b and 2c, Church Street, Staines.—Last day for proofs for dividend April 12th. Trustee, Mr. T. Gourlay, Official Receiver, 29, Russell Square, W.C.1.

H. A. HYDE, wireless dealer, 148, Weston Park, Crouch End, late of Bromley.—Receiving order made March 26th, on debtor's own petition.

J. B. WICKSTEAD, R. J. ALLEN and L. KNIGHT (C. Cooper and Co.), plumbers, electrical engineers, &c., 26, King Street, Stretford.—First meeting April 12th, at the Official Receiver's offices, Byrom Street, Manchester. Public examination May 17th, at the Court House, Salford.

E. R. H. SYMONDS, electrician, 40, Victoria Road, Great Yarmouth.—First and final dividend of 2s. 3d. in the £, payable April 10th, at the Official Receiver's office, 9, Queen Street Chambers, Norwich.

H. C. WINGFIELD, electrician, 47, Carholme Road, Lincoln.—First and final dividend of 2s. 4d. in the £, payable at the Official Receiver's office, 10, Bank Street, Lincoln.

Dissolutions of Partnership.

RUSSELL INSTITUTE OF MEDICAL ELECTRICITY, medical electricians, 23, Marlborough Buildings, Bath.—Mr. W. Thomas and Mr. F. C. Bennett have dissolved partnership. Mr. Thomas will attend to debts.

SUPER WELDING CO., electric and oxy-acetylene welders, Gorton Street Works, Greengate, Salford.—Mr. T. C. Futers and Mr. R. S. Hughes have dissolved partnership. Mr. Hughes will attend to debts and continue the business at the old address on his own account.

Private Arrangements.

CECIL HODGES & CO., LTD., manufacturing electrical engineers, Salfords, Surrey.—A meeting of the principal creditors was held on March 27th. Mr. R. F. Frazer, the receiver appointed by the bank, presided, and read a balance-sheet dated December 31st last, which disclosed gross liabilities of £36,500, made up as follows:—Issued capital, £14,500; first debenture (held by bank), £7,500; second debenture, £1,000; and sundry creditors, £13,500. The assets consisted of freehold plant and factory, £8,500; lease of Dalston premises (sold), £450; plant and machinery, £2,000; fixtures and fittings, £350; motor-car, £10; stock, £5,700; goodwill, £1,400; book debts, £3,970; and there was a debit on the profit and loss account of £14,330. The chairman stated that the concern was registered as a private company on February 23rd, 1910. The early years of the company were moderately successful, and from 1921 onwards it was a purely family concern, the shareholders being Messrs. Cecil Hodges, the founder, H. Hodges and Howell. The net profit in 1921, after allowing for the directors' fees, &c., was £295, and in the following year the profit was £100. In 1923 there was a loss of £530, after charging £1,250 for the managing director's salary. The following year there was a profit of £352, after charging directors' fees totalling £1,700, and in the succeeding 12 months there was a net profit of £296, after allowing £1,500 for the managing director's salary. In 1926 the whole of the profit was distributed in directors' fees, and there was practically no net profit. At December 31st, 1926, the profit and loss account was in credit to the extent of £370, the goodwill being included at £1,400. Further capital to the extent of £10,000 was obtained, and the bank overdraft was increased from £3,000 to £7,500, and £1,000 was obtained on a second debenture. Certain people who had invested money in the company were given positions as travellers. In 1926 the company's sales were £29,000, with a gross profit

of £9,000. During 1927, however, the sales declined to £26,500, and the gross profit was only £2,000. In 1926 the total overhead expenses, excluding the directors' remuneration, were £7,000, but last year they increased to £14,000. After allowing for all the expenses last year, but before providing for the directors' salaries, there was a net loss of £12,000. The principal creditors were of the opinion that it might be best for the business to be continued. During February the sales of the company were £3,700, and he believed that a small net profit was made. A judgment had been obtained against the company by a creditor for £1,500, who had presented a petition for the liquidation of the company. The petition was fixed for hearing on April 2nd. It was decided that the petition should be opposed, and a committee of the three largest creditors was appointed to confer with the receiver for the purpose, if possible, of bringing about a scheme of reconstruction. The committee consisted of the representatives of Messrs. Brion & Co., Paris, the Chloride Electrical Storage Co., Ltd., and Willmer & Son, London.

Edinburgh and Foreign Plant.

On the instruction of the Edinburgh Corporation Electricity Committee a report has been prepared by Mr. Imrie, City Chamberlain, and Mr. Seddon, engineer and manager of the Electricity Supply Department, on the publication by the British Electrical and Allied Manufacturers' Association of certain statements with regard to foreign plant in British power stations (*vide* ELEC. REV., February 10th, p. 236). The statements, it is pointed out, conveyed that the Corporation undertaking had suffered a capitalised loss of £200,000 as a result of the purchase of Swiss plant. That sum was arrived at by comparing the cost of fuel in Edinburgh with the cost of fuel at a similar station equipped with British plant. The actual figures are analysed, but on the question of fuel consumption it is stated that fuel costs depend not only on generating plant, but also on the price of coal; the cost of unloading coal and disposing of ashes; the efficiency of boiler plant; and the nature of the auxiliary plant. Thus it was impossible for the B.E.A.M.A., with the data at its disposal, to say what caused the alleged losses.

With the object of ascertaining to what extent the figures published by B.E.A.M.A. were accurate, the reporters checked the figures pertaining to Edinburgh, and find them correct. They are, however, unable to check the figures relating to the unknown station. It should be noted that in 1922 Edinburgh had four generating stations in operation. In only one of these stations had foreign machinery been installed—namely, three 10,000-kW sets at Portobello. The financial year had run more than half its course before the first of the sets was put on commercial load. For the first year mentioned in the table, therefore, out of the 55 million kWh of output only 8¼ millions was generated by foreign plant. The loss of £30,740, alleged to have been suffered by the Corporation during the year, cannot accordingly be attributed to the foreign plant. The real reason for the probable difference of £30,740 referred to was that the Edinburgh undertaking was working with out-of-date British plant, which was then about to be scrapped in favour of new and more up-to-date machinery. On the best showing which the B.E.A.M.A. could make the figures showed a phenomenal improvement every year, with the result that the alleged loss dropped from £30,740 in 1922-23 to £9,176 in 1925-26, with increasing use of foreign plant. This improvement has really been accounted for by the modernisation of plant. Their consulting engineers stated that, although the price of the Swiss turbines, wi British condensing plant, was 35 per cent. lower than all-British plant, the efficiency compared favourably with the average of the British offers. The engineer is satisfied that the Swiss plant has come up to the standard guaranteed by its makers. The reporters state most emphatically that the Corporation has not lost by the purchase of Swiss plant.

Swiss Aluminium Interests.

The report of the Aluminium Industry Company of Neuhausen states that the sales in 1927 further increased, and the whole of the production was disposed of, while new scope for activity was provided by the production of new alloys. The German companies in which the company is interested realised satisfactory results last year, and the French company worked in a normal manner. The Spanish works started production, and the aluminium works at Porto Marghera, near Venice, is at present being put into operation.

For Sale.

By order of the receiver for the debenture holder of Allied Electric Manufacturers, Ltd., Messrs. J. J. Greaves & Sons will sell by auction at Aldine Court, Sheffield, on April 12th, the whole of the stock-in-trade, including electrical fittings, accessories, cables, wire, &c. Mr. G. R. Lightfoot will sell by auction on April 18th, at 13, High Holborn, W.C.2, a quantity of electrical and wireless material. Hackney Borough Council Electricity Department invites offers for one 35-h.p. B.T.-H. motor, direct coupled to a Davidson fan. (See our advertisement pages to-day.)

Welco Patents, Ltd.

Mr. Ernest Greenhill, 13, Bennetts Hill, Birmingham, states that he has ceased to carry on the business of this company and has sold the stock-in-trade, fixtures, &c., for the purpose of meeting the charge under the debentures.

Book Notices.

Handbook Series of the U.S.A. Bureau of Standards. No. 3, "National Electrical Safety Code," fourth edition.—This edition represents only minor changes in the general substance of the rules approved by the American Engineering Standards Committee. The greatest changes are probably to be found in the regulations dealing with overhead line construction.

Descriptive Account and Catalogue of the Home Office Industrial Museum and Exhibits. H.M. Stationery Office, price 3s. 6d. net.—Apart from the actual description of the apparatus at the Museum, this book contains a mass of information on questions of safety, health and welfare in industry.

Scientific Papers of the U.S.A. Bureau of Standards. No. 567, "Some Principles Governing the Choice and Utilisation of Permanent-magnet Steels" (5 cents); No. 568, "Methods, Formulæ and Tables for the Calculation of Antenna Capacity" (20 cents); No. 570, "Thermal Expansion of Alloys of the 'Stainless-iron' Type" (10 cents).

"The Home Electrician"; Part 1, Electric Light Accessories. By T. M. F. Tamblyn-Watts, A.M.I.E.E.—This is the second part of this work which has been published; the other dealt with "Notes on Electricity Rates." Detailed practical instruction is given on the construction, fixing and repair of accessories and the detection of faults in domestic electrical apparatus.

Hungarian Electrical Exports.

According to the *Board of Trade Journal*, the exports of electrical machinery and apparatus from Hungary during 1927 were valued at 15,807,000 pengös (about £564,000).

Prices of Raw Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.		Price April 2nd.	Fortnight's inc. or dec.
a	Acid, Oxalic	per lb.	5¾d.	...
a	Ammoniac, Sal	per ton.	£60	...
a	Ammonia, Muriate (large crystal)	,,	£52	...
a	Bisulphide of Carbon	,,	...	...
a	Borax	,,	£25	...
a	Copper Sulphate	,,	£35 10s.	...
a	Potash, Chlorate	per lb.	3½d. to 4d.	...
a	,, Perchlorate	,,	5½d.	...
a	Shellac	per cwt.	£13 10s.	...
a	Sulphur, Commercial	,,	£11	...
a	,, Roll	,,	£11	...
a	Soda, Chlorate	per lb.	3d.	...
a	,, Crystals	per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ...	per lb.	3½d.	...
	METALS, &c.			
b	Aluminium, Ingots	per ton.	£105 to £112	...
b	,, Wire	per lb.	1/3 to 1/9	...
b	,, Sheet	,,	1/3 to 2/9	...
p	Babbitts Metal and Anti-friction Metal—			
	Grade I	per ton net.	£2'8	£6 inc.
	Grade II	,, ,,	£151	£4 inc.
	Grade III	,, ,,	£79	£1 inc.
c	Brass (rolled metal 2" to 12" basis)	per lb.	9½d.	...
c	,, Tubes (solid drawn)	,,	11½d. to 1/-	...
c	,, Wire, basis	,,	9½d.	...
c	Copper Tubes (solid drawn) ...	,,	1/1	...
c	,, Bars (best selected) ...	per ton.	£92	...
c	,, Sheet	,,	£92	...
c	,, Rod	,,	£92	...
d	,, (Electrolytic) Bars ...	,,	£87	5/- inc.
d	,, ,, Sheets ...	,,	£143 10s.	...
d	,, ,, Wire Rods ...	,,	£77	5/- inc.
d	,, ,, H.C. Wire	per lb.	9½d.	...
f	Ebonite Rod	,,	2/3 to 2/6	...
f	,, Sheet	,,	2/3 to 2/6	...
n	German Silver Wire	,,	2/2	...
h	Gutta-percha, fine	,,	6/3	...
h	India rubber, Para fine	,,	1/0½	½d. dec.
l	Iron Pig (Cleveland No. 3.) ...	per ton.	£5/-	...
l	,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g	Lead, English pig	,,	£21 10s.	5/- inc.
g	Mercury	per bot.	£22 5s. to £22 10s.	5/- inc.
e	Mica (in original cases) small ...	per lb.	3d. to 3/-	...
e	,, ,, medium ...	,,	4/- to 8/-	...
e	,, ,, large ...	,,	10/- to 20/- & up	...
p	Phosphor Bronze, plane castings	,,	1/3½	...
p	,, ,, drawn bars & rods	,,	1/3	...
p	,, ,, rolled strip & sheet	,,	1/3½	...
p	,, ,, wire...	,,	1/3½	...
e	Platinum	per oz.	£17 15s.	...
d	Silicium Bronze Wire	per lb.	10½d.	...
r	Steel, Magnet, in bars	,,	7½d.	...
n	Tin, Block (English)	per ton.	£241 to £242	£8 10s. to £9 inc.
n	,, Wire, Nos. 1 to 16	per lb.	9/10	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
i Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Messrs. James Forster & Co. reported, under date March 31st:—"No change is discernible in the general position of lead supply and demand. The latter is still very moderate, and, considering the time of the year, very disappointing, but supplies are not pressing unduly on the market, hence the present steadiness. Whatever the future may bring forth, we can see little reason at present for an advance in values, the only 'bullish' point being that the price is a moderate one."

New French Company.

A company has been formed in Paris, with a capital of 25 million francs and the title La Société Electricité et Eau de Madagascar, to take over and extend the undertaking of the Société de l'Energie Industrielle de Madagascar.

Calendar.

Once again the Metropolitan-Vickers Electrical Co., Ltd., has brought pleasure to our hearts and revived our drooping spirits by sending us one of its "Girl" calendars. This one, which will last until the end of March, 1929, will charm away the sadness of the 1927-28 girl. It is the fourteenth of the series, and becomes more indispensable every year.

East Kent Contractors' Dinner.

The fifth annual dinner of the East Kent Branch of the Electrical Contractors' and Allied Associations, held at the Royal Hotel, Ramsgate, on March 22nd, was presided over by Mr. A. F. Dunkley, the chairman of the branch. Amongst the guests were the president of the E.C.A., Mr. W. A. Shaw, the general secretary, Mr. L. C. Penwill, the Mayors of Ramsgate and Margate, and the vice-chairman of Broadstairs Urban District Council, Councillor J. A. Forde, A.M.I.E.E., the chief engineer of the Isle of Thanet Electricity Supply Co., Ltd. About 60 members and guests were present, and speeches were delivered by those already mentioned and by Mr. C. E. Hume, the chief engineer of the Ramsgate and District Electrict Supply Co., Ltd., Mr. W. Wilson, the chief engineer of the Ashford electricity undertaking, as well as by representatives of manufacturers and wholesalers. Strong support to the movement for trade affiliation was given by the Mayor of Margate, and the necessity for a simple code of wiring rules which should be made compulsory was urged by the supply engineers and by Lt.-Col. S. H. Page, C.M.G., who spoke on behalf of the architects and consultants. Mr. C. O. Clark, the secretary of the Dinner Committee, in proposing the toast of the manufacturers, emphasised the necessity for a strong body of organised contractors to strengthen the fair trading policy which was now so much in evidence in negotiations between contractors and manufacturers. Mr. E. A. Pinto, A.M.I.E.E., drew attention to the cursory manner in which electrical work was referred to in many architects' specifications and to the lack of provision of facilities for electrical installations in new buildings. He also gave particulars of a glaring case of "shoddy wiring" in a municipal building now in course of erection, and pointed the moral that in every case a competent architect or consultant should be employed before electrical work was put out to tender.

The Swedish Electrical Industry.

The February *Swedish Economic Review* states that during the last quarter of 1927 employment in the ore-mining and metal industries was better on the whole. The electro-mechanical industry reported the best employment of the whole group. The group "other metal industries," including electrical fittings factories, also gave a satisfactory report. It is shown in the *Review* that during 1927 the value of electrical machinery exported from Sweden was 34,342,000 kronor, as compared with 27,181,000 kr. in 1926. Telephone and telegraph apparatus to the value of 9,819,000 kr. was exported during the same period, as against 7,434,000 kr. in the preceding year.

Lighting and Power Notes.

Bedford.—Electricity Extensions.—The Town Council has been urged by the Electricity Commissioners to carry out a larger extension scheme at the power station, and to install a 12,500-kW set in lieu of the proposed 7,500-kW set. The Council has adopted the extended scheme, and is to apply for sanction to a loan of £101,750.

Bournemouth.—Electricity Charges.—At a Special Joint Committee representing Bournemouth Corporation, Poole Corporation, Christchurch Corporation and Christchurch Rural District Council, Mr. Arthur Collins (financial consultant) and Mr. J. H. Rider (consulting engineer) explained certain matters arising out of their reports, and discussed with the Joint Committee points in connection with charges for electricity. The Committee expressed the opinion that the terms offered by the company with regard to an extension of tenure were not so satisfactory as to satisfy the Committee that it could recommend its respective Councils to adopt them, and, in the circumstances, decided to ask Mr. Collins and Mr. Rider to interview the company to discuss the possibility of agreeing on a purchase price for the undertaking, for further consideration by the Joint Committee.

Bury.—Year's Working.—We have received from Mr. J. G. Potts, engineer and manager of the Corporation electricity undertaking, a copy of his report, together with the statement of accounts for the year ended March 31st last. The total revenue amounted to £123,717, as compared with £100,747 in 1925-26, and working expenses were £89,209, as against £53,266, leaving a gross profit of £34,508 (£57,481). After payment of capital charges there was a net loss of £672, as compared with a surplus of £7,837 in the preceding year. The capital expenditure during the year amounted to £29,968, the chief items being £13,395 on the Chamber Hall power station, and £10,304 on mains and sub-stations. The electrical energy sold increased from 21,091,253 to 23,211,588 kWh, and the maximum supply demanded from 9,120 to 9,900 kW. The generating cost per kWh increased from 0.606d. to 0.922d., for which the increased cost of fuel, owing to the coal dispute, was responsible. The charges were consequently raised, and the average price obtained per kWh was 1.279d., as against 1.145d.

Canada.—Electrical Development.—The Ontario Hydro-Electric Power Commission intends during the present year to construct rural distribution lines, the mileage of which will be greater than that of the whole of the rural systems existing in the Province at the end of 1924. This programme of construction will involve the expenditure of over $2,500,000, to supply about 6,600 rural consumers from 1,050 miles of line. At the end of the past fiscal year ended October 31st, 1927, rural lines constructed or under construction served 25,800 rural consumers, involving 3,150 miles of line and a capital expenditure of $6,680,000. The twentieth annual report of the Commission, now in course of preparation, shows the total investment in plant and assets to have reached $284,000,000, with reserves amounting to $65,000,000. The chairman looks on the St. Lawrence River as the chief source of supply for the future, but feels that, taking into account the contracts for 100,000 and 260,000 h.p. from the Ottawa river, there is no reason to anticipate a power shortage within the next four or five years.

Cheltenham.—Loans Sanctioned.—The Corporation Electricity Committee has received sanction to borrow £3,033 for mains to Cleeve Hill and £853 for plant and kiosks.

Doncaster.—New Plant.—A new turbo-generator, of 7,500-kW capacity, with condensing plant, &c., the first part of extensions to the Corporation electricity works, was set in operation on March 29th by the Mayor. The second part of the work, which includes two new water-tube boilers for steam-raising, will be commenced in a few weeks' time.

Dover.—Loan.—The Corporation Electricity Committee has recommended that application be made for sanction to a loan of £3,000 for mains.

Dumfriesshire.—Electricity Supply.—The County Council is considering the question of the provision of an electricity supply for the county, and will probably have to rely for a bulk supply upon one or more transforming and distributing stations forming part of one of the links of the network of national main transmission lines, which main line or link will probably pass from Kilmarnock, by way of Dumfries, to Carlisle. It may be assumed that the line will be tapped in the neighbourhood of Dumfries. The county clerk is of opinion that technical advice should be obtained, and that information might be sought as to the terms on which electricity could be obtained from all possible sources to meet the needs of Gretna and Eastriggs.

Fleetwood.—Assisted Wiring Scheme.—The Town Council has been recommended to introduce an assisted wiring scheme to apply to 100 houses per annum. It is also recommended that electric radiators, vacuum cleaners, and cookers be let out on the hire-purchase system.

Glasgow.—Progress during February.—Under the Corporation Electricity Department's scheme 410 houses were wired in February, making the total to date 6,976, while the number of applications for the hire of appliances was 263, making the total 18,902.

Inauguration of Destructor Works.—It has been arranged that H.R.H. Prince George will open the new refuse disposal works on April 27th.

Hoylake and West Kirby.—Electricity in Bulk.—The Urban District Council has accepted the offer of the Birkenhead Corporation for a partial bulk supply of electricity, subject to an agreement to be approved by the Electricity Commissioners. Recently a deputation of the Electricity Committee interviewed the Commissioners, but they declined to sanction any extension of the present steam plant and suggested the alternative of a supply from Birkenhead or Wallasey. The Council now has 4,162 consumers.

Innerleithen (Peebles).—Street Lighting.—The Town Council is considering a scheme for street lighting by electricity, and an offer from the Galashiels and District Electric Supply Co. to supply fittings and connect up new brackets in the lamps at a cost of £2 5s. per lamp is being considered. The cost of electricity will be 2s. 9d. per hundred hours, compared with 2s. 3d. for the same period for gas.

Irish Free State.—Pembroke (Dublin).—At a recent meeting of the Urban District Council a report from the chief electrical engineer with regard to plant extensions at a cost of £36,000 was considered, and it was decided that the report should be submitted to the Electricity Commissioners, with the statement that it had not been adopted by the Council, and requesting the Commissioners' observations on the matter.

Liskeard (Cornwall).—Inquiry Result.—The report of the Electricity Commissioners on the inquiry recently held into the Liskeard Gas and Electricity Co.'s application for a Special

Order has now been received. Residents in the vicinity of the power station opposed the Order on the grounds of alleged noise and smell, and the Commissioners state that they have come to the conclusion that the objectors have considerable grounds for their contention that the nuisance is at present being caused by noises and smell from the Diesel sets installed in the station. They are of opinion that the company should call in a consulting engineer to advise as to what steps can be taken to abate this nuisance, and have accordingly deferred further consideration of the application for the Special Order until they are satisfied that adequate steps are being taken to mitigate it.

London.—STEPNEY.—The Finance and Parliamentary Committee has received from the Electricity Supply Committee a report by the borough electrical engineer on the provision of mains, &c., to meet requirements until March, 1930, and has recommended that application be made for sanction to loans totalling £151,500, made up as follows: E.h.p. feeders, £22,400; l.p. feeders, £60,600; services, £55,500; meters, demand indicators, &c., £13,000.

BATTERSEA.—The Committee reports that no specific extension of any selected station is prescribed by the London Electricity Scheme, but, as the result of recent negotiations, the Central Electricity Board has suggested that the Council should amend its application now before the Electricity Commissioners for a 10,000-kW set by substituting a set of the largest size which can be accommodated in the existing buildings of not less than 25,000-30,000 kW, and the Committee has also received a letter from the Commissioners in somewhat similar terms. The electrical engineer has reported that the space available in the turbine room is sufficient to accommodate a set of 30,000-kW capacity. The estimated cost of this set, together with the necessary boiler and auxiliaries, and including an extension of the boiler house to accommodate a portion of the additional boiler plant, is £266,458. The estimated cost of the 10,000-kW set and boilers, &c., was £97,000. The Committee has recommended that the electrical engineer's estimate be approved, and that application be made for consent to the revised extension now proposed.

The Committee has received sanction to the borrowing of £54,000 for mains and services.

Merthyr.—HYDRO-ELECTRIC SCHEME.—At a recent meeting of the Corporation a letter was read from the Merthyr Electric Traction and Lighting Co., Ltd., giving formal notice of its application to the Electricity Commissioners for sanction to erect a hydro-electric power station, and depositing plans with the Council to comply with the Electricity (Supply) Act, 1919.

Milford Haven.—ELECTRICITY SCHEME.—At a recent public meeting, Mr. Arthur Ellis, consulting engineer, of Cardiff, outlined the proposed electricity scheme adopted by the Urban District Council. He said that the estimated capital cost of the original scheme for the first and second years was £23,580, and for the third year, £28,379. A loss of £357 was anticipated for the first year, but the second and third years should produce profits of £395 and £874 respectively. Since the scheme had been prepared an agreement had been arranged with the Milford Docks Co. for a supply of electricity to the docks which would mean an addition of 20 per cent. to the capital expenditure but would double the output.

Norwich.—INQUIRY.—The *East Anglian Daily Times* reports that an inquiry was held at the Guildhall on March 22nd in connection with the proposal of the Corporation to supply East Dereham with electricity by means of an overhead cable from Wymondham. Mr. T. Gordon Tucker conducted the inquiry on behalf of the Ministry of Transport. The inquiry chiefly referred to the granting of wayleaves. The Earl of Kimberley said that he was not opposed to the electricity extension, and wished to do all that was possible to help. What he had fought against was the placing of poles down the centre of a field. Considerable evidence was heard with reference to amendments of the route, and the Inspector visited the localities mentioned in the scheme. A decision will be given in due course.

Plymouth.—ELECTRICITY SUPPLY.—The Corporation Electricity Committee has authorised the engineer to raise the pressure of the supply to certain consumers from 100 V to 200 V. The estimated cost of the work is £6,900, and it will be carried out as occasion arises.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

REDRUTH AND CAMBORNE.—*The Urban Electric Supply Co., Ltd.*—Lighting: From 1s. to 10d. per kWh.

HUDDERSFIELD.—Three-phase power: From scale charge, plus 12½ per cent. to scale charge only, and reduction of the guarantee charge per kW installed from £1 per h.p. per annum to 15s.; single-phase domestic supply—consumers have a choice between the existing rate (4d. per kWh for lighting and 1d. for power), or a standing charge of 15 per cent. per annum of ratable value, plus ½d. per kWh for all energy consumed; single-phase industrial consumers—from 4d. per kWh for lighting and 1½d. for heating and power, to 4d. for lighting and 1½d. for power, &c., under a guarantee of 7s. 6d. per h.p. or per kW installed per half-year; retail shops—electricity for power, from 1½d. to 1¼d. per kWh.

RAMSGATE.—Lighting: First 500 kWh per quarter, 7½d. per kWh; beyond, 7d. Power: First 3,000 kWh per quarter, 4d. per kWh; beyond, 2½d.

WINCHESTER.—Lighting: Flat rate from 7½d. to 7d. per kWh. The rentals of ordinary lighting meters reduced by approximately 33⅓ per cent.

LONDON.—*The Metropolitan Electric Supply Co.*—Lighting: A reduction of 1d. per kWh.

HAWORTH.—Lighting: First 250 kWh per quarter, 6d. per kWh; next 250 kWh, 5½d.; over 500 kWh, 5d.

STIRLING.—Lighting: Flat rate of 4d. per kWh. Power: First 100 kWh per quarter, 3d. per kWh; next 900 kWh, 1½d.; next 1,000 kWh, 1¼d.; over 2,000 kWh, 1d. per kWh. Heating: First 100 kWh per quarter, 2d. per kWh; beyond, 1d. per kWh, with a minimum charge of 10s. per annum.

Sandwich.—INAUGURATION OF SUPPLY.—A supply of electricity to the town by the South-East Kent Electric Power Co. was commenced on March 20th. Electricity is obtained from Betteshanger Colliery, and is conveyed to the town by overhead lines.

South Africa.—JOHANNESBURG.—According to the *Cape Times*, a letter has been received by the Johannesburg Municipality from the Victoria Falls Power Co., in which proposals are made to link up the electricity systems of the Municipality and the V.F.P. It is suggested that by so doing it would not be necessary for the Municipality to commit itself to large additions to the present plant, which would otherwise be necessary.

Special Orders.—Applications have been made to the Electricity Commissioners for Special Orders by Richard Borlase Matthews authorising him to supply electricity in parts of the administrative counties of Kesteven and Lindsey (Lincolnshire), and the Wareham Electricity Supply Co. (1928), Ltd., authorising the transfer to the company of the undertaking authorised by the Wareham Electricity Special Order, 1922.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—The Union Electric Light and Power Company of St. Louis, Mo., has for several weeks been conducting a survey to ascertain whether it can profitably develop water power on the Osage River, six miles above Bagnell, Mo. According to the *Electrical World*, the project comprehends a dam 100 ft. high, creating a lake 100 miles long, and a power house with a capacity of 100,000 h.p. The entire project would cost approximately $25,000,000.

At Osceola, about 40 miles south-west of Bagnell, the Ozark Utilities Company has begun the construction of a dam near the junction of the Osage and the Sac, which will supply power to 35 towns, besides making the Osage navigable for 30 miles and the Sac for 20 miles above Osceola.

Willesden.—ELECTRICITY CHARGES.—The Town Council has approved the following revised electricity charges:—Lighting—From 4½d. to 4d. per kWh. Power and heating—A flat rate of 1d. per kWh. The tariff for bulk supply to large consumers has also been substantially modified. A new long-hour lighting tariff for all-night garages, shops, signs, &c., has been approved on the basis of ½d. per quarter per watt of lighting installed, plus 1½d. per kWh. A special and entirely new tariff has been introduced which applies to combined water heating and lighting in domestic premises upon a fixed quarterly charge for the apparatus and all energy used, whether for lighting or water heating, which will nearly approach the ideal of 100 per cent. load factor.

Tramway and Railway Notes.

Australia.—ADELAIDE.—The statement of accounts of the Adelaide Municipal Tramway Trust for the half-year ended July 31st last shows a total revenue of £381,157 and operating expenses of £280,022, leaving a surplus of £101,136 available for appropriation. This was disposed of as follows:—Reserve for renewals, £19,670; interest (average rate paid for half-year on balance of advances for construction, 5.64 per cent.), £69,821; provision for the estimated current expenses during the next month, £11,644. The passengers carried on the Adelaide electric system totalled 32,005,119, an increase of 2.53 per cent. as compared with the corresponding period in 1926, and the car miles run amounted to 3,471,456.

Chester.—PROPOSED ABANDONMENT OF TRAMWAY.—At a meeting of the Corporation on March 28th, a recommendation by the Tramways Committee that application be made for powers to substitute for the existing tramway system, motor 'buses, and that the application should include general powers to enable the Corporation to extend its 'bus routes anywhere in the city and anywhere within a district having a radius of five miles from the Chester Cross, was considered. It was stated that the cost of constructing the tram track from Saltney to the General Station would be £61,500, and with electrical appliances costing £11,170, the total amount would be over £72,000. The Committee's recommendation was adopted.

Chesterfield.—INQUIRY.—An inquiry was held recently by the Ministry of Transport into the Corporation's application for sanction to extend the railless-car system to New Whittington. The cost of the scheme is estimated at £7,700.

Continental.—FRANCE.—The local railway between Annemasse and Samoens of the Société des Chemins de Fer Economiques du Nord is to be electrified.

ITALY.—Contracts have been placed for the electrification of the railway between Savona and Ventimiglia. The work, which includes the establishment of six transformer stations, has to be completed within two years.

Glasgow.—NEW ROUTE.—The Corporation Tramways Committee has decided to lay a double line of tramway from Garngad terminus to the first loop east of the railway bridge at an estimated cost of £3,380.

Kirkcaldy.—TRAMWAY *v.* OMNIBUSES.—In view of the excessive 'bus competition by private firms which has recently been introduced into the town to the detriment of the tramway undertaking, a Special Committee of the Corporation is now deciding upon alterations in fares and stages to meet this competition. The *Electric Railway and Tramway Journal* reports that, in general, the change will mean the reduction of fares by half and the introduction of overlapping stages on all routes.

Plymouth.—RE-POSITIONING OF TRACK.—At a recent meeting of the Corporation Tramways Committee the town clerk and engineer reported with regard to the question of re-positioning the tramway track at Camel's Head, Pound Street, and Tavistock Road, Devonport, in view of the Minister of Transport's decision that he was not prepared to grant assistance towards the cost of the work. The Committee decided to proceed with the work in Pound Street at a cost of £2,437 and at Camel's Head at a cost of £5,694.

Telegraph and Telephone Notes.

"Beam" Radio-Telegraphy.—AUSTRALIAN SERVICE.—It is understood that the Post Office has made the final payment to Marconi's Wireless Telegraph Co. in respect of the Australian wireless service and Canadian service stations which it built for the Post Office.

Canada.—TELEGRAPH SERVICE PROFIT.—In 1927 a net profit of 463,967 dollars (£80,793) was made by the telegraph service, which is operated by the Canadian National Railways. In 1920 there was a loss of £20,498. Rates vary according to distance and time of dispatch.

Germany.—TELEGRAPH SERVICE SUBSIDY.—The inland telegraph system never produces a profit, but has to be subsidised by the Government. The exact subsidy for 1927 has not yet been definitely stated, but the Ministry of Communications admits that it will amount to at least 30,000,000 gold marks (£1,500,000).

Hull Telephone System.—EXTENSION.—There is to be a further extension of the automatic telephone equipment in Hull. A new exchange in Newington is to be opened this month, and the Corporation Telephones Committee has adopted a report by the manager (Mr. T. Holme) on additional equipment and structural alterations to the central exchange; to anticipate demands provision is to be made for 1,000 additional lines. The chairman (Alderman E. Ombler) said the automatic system was working well, and street kiosks had proved of service to the public and a paying proposition to the Corporation.

International Telephony.—CZECHO-SLOVAKIA.—The Czecho-Slovakian Long-Distance Cable Co., Ltd., is engaged on the installation of a long-distance telephone cable between Pilsen, Nuremburg, Brunn, and Olmutz; next year lines between Prague and Carlsbad, and between Lobositz, Teplitz, and Carlsbad are to be installed.

Irish Free State.—RADIO COMMUNICATION.—In Dail Eireann the Minister for Posts and Telegraphs was recently asked whether any negotiations were proceeding, or had been concluded, with the British Government, or with any telegraph company, respecting wireless stations for communication with places outside Ireland. Mr. Heffernan, Parliamentary Secretary to the Ministry for Posts and Telegraphs, said that the Convention with the British Government in respect of submarine cables and wireless stations, which was provided for in the annex to the Treaty, had not yet been made.

Telephony in the Colonies.—AUTOMATIC PLANT.—We are informed that two more automatic telephone exchanges in the Colonies have been completed by Siemens Brothers & Co., Ltd., Woolwich, and have recently been brought into service. They are Salisbury (Rhodesia), with an initial equipment of 1,000 lines and an ultimate one of 3,000, and at Sherwood (Brisbane, Australia), initial 900 lines, ultimate 2,000. In both of these exchanges No. 16 equipment is installed, Sherwood being a satellite in the Brisbane multi-exchange area, which this firm has now in hand.

Transatlantic Telegraphy.—NEW CABLE.—A new loaded telegraph cable is to be laid between Newfoundland and the Azores by the Western Union Telegraph Co. of America. It has been specially designed for duplex working at high speed, and, according to the *Financial News*, its manufacture and laying are being carried out by the Telegraph Construction and Maintenance Co., Ltd., of London.

Radio Notes.

Denmark.—NEW STATION.—A new short-wave broadcasting station has been opened by the journals *Radiolytteren* and *Popular Radio* in Copenhagen. Its call sign is 7RL and it operates on a wave-length of 42.12 m, or 7,122 kc.

"Outside" Broadcasting.—SMALL MICROPHONES.—For broadcasting a running commentary on the Grand National horse race at Aintree six microphones were utilised. Three of them were specially constructed, measuring only 2 by 1¼ inches, and could be accommodated comfortably in the palm of the hand; but as the commentator required both hands free to use his field-glasses, the microphones were clamped to an iron rail and spaced over a distance of about 2¼ feet, so that as the commentator turned his head to follow the horses one or other was within six inches of his mouth. These diminutive instruments are not as sensitive as the normal type, but the quality is declared to be as good as any that has hitherto been obtainable by wireless, and the use of "insensitive" microphones was intended to enable the crowd effects to be more carefully controlled, so that the speech would not be drowned by the incidental noises of the course. It must be remembered that the commentator spoke in the midst of a noisy and enthusiastic crowd. A separate microphone was used for preliminary announcements, and two others were placed in front of the stand to pick up crowd noises and to be in reserve for the commentators if required.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the ELECTRICAL REVIEW containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—SYDNEY.—May 16th. N.S.W. Government Railways. One water-tube boiler and accessories for Zara Street power house, Newcastle. (Spec. 10s.)

July 18th. Six water-tube boilers and accessories for Ultimo power house. (Spec. £2.) Chief Electrical Engineer, 61, Hunter Street, Sydney, New South Wales.

Municipal Council. Paper-insulated 660-V cables. (B.X. 4319.)*

MELBOURNE.—May 8th. P.M.G.'s Department. Standard resistances, condensers, &c. (B.X. 4274.)*

Bath.—April 13th. Electricity Department. One 3,000-kVA, 6,600/11,500-V transformer. (March 30th.)

Belgium.—April 16th. Provincial Government authorities of Hasselt. Twenty-five static transformers, 40 "potential reducers," and 40 "potential intensifiers."

April 17th. The municipal authorities of Saint Gilles, Brussels. 850 amp.-hour and four watt-hour meters. Particulars from Service de l'Electricité, 40, Rue de Bethleem, Saint Gilles, for 5 francs.

Biggleswade.—April 18th. Beds. E.C. Electric lighting installation at the school, cookery and manual instruction centres. County Surveyor, Shire Hall, Bedford.

Canada.—H.M.'s Trade Commissioner at Vancouver reports that a Canadian firm requires one 2,500/3,000-kVA turbo-alternator set, 2,500 V, 3-phase, 60-cycle, including condensers, air pumps, &c. (B.X. 4276.)*

Clutton.—April 23rd. Board of Guardians. Electric lighting installation, Institution. Mr. I. Hood, engineer, 40, Queen's Road, Clifton, Bristol. (Returnable deposit of £2 2s.)

Egypt.—Cairo.—May 17th. Ministry of the Interior. Two Diesel engine driven generating sets for Mansourah. (B.X. 4277.)*

Epsom.—April 17th. Electricity Department. Two 500-600-kW Diesel engine-driven alternators and accessories, e.h.p. and l.p. switchgear, one 500-kW rotary convertor, two sub-stations with transformers and switchgear, e.h.p. cable and laying, cooling tower, and fuel-oil storage tank. (March 30th.)

Fort William.—April 24th. North British Aluminium Co., Ltd. Structural steelwork for power house, &c., for the Lochaber water power scheme. Specifications from the company's offices, Adelaide House, E.C.4.

Glasgow.—June 4th. Trustees of the Clyde Navigation. Electric cantilever crane of 175 tons, 150 tons, and 130 tons lifting capacity, for Glasgow Harbour. Specifications and forms of tender from Mr. Daniel Fife, mechanical engineer, 16, Robertson Street, Glasgow (three guineas deposit).

Guildford.—April 12th. Town Council. Electric wiring of 80 flats and 24 houses, Aldershot Road. Mr. J. W. Hipwood, borough surveyor.

Hull.—April 19th. Electricity Department. 33-kV overhead transmission line and outdoor switchgear. (March 30th.)
June 25th. Telephone Committee. One automatic telephone exchange (4,000 lines). (See this issue.)

India.—May 1st. India Store Department. Two Diesel locomotives for 5 ft. 6 in. gauge. Forms of tender (5s.) from the Store Department, Belvedere Road, S.E.1.
April 20th. 500-kVA transformers. (See this issue.)

London.—Paddington.—April 12th. Great Western Railway. Electric wires and cables, telegraph ironwork, electric lamps. (March 23rd.)
Metropolitan Asylums Board.—April 18th. Installation of electric lighting on fire-escape stairs at the Northern Fever Hospital, Winchmore Hill; installation of electric bells at the hostel, Little Gray's Inn Lane, W.C.; and installation of a fire-alarm system at the Northern Fever Hospital. (See this issue.)
Installation of electric supply cable and switchgear between Joyce Green Hospital and Long Reach Smallpox Hospital, Dartford. (See this issue.)

Manchester.—April 12th. Central Purchasing Committee. Incandescent lamps for 12 months. (March 23rd.)
April 18th. Waterworks Committee. Renewal of positive and negative plates in storage battery at Longdendale Works. (See this issue.)

Middlesbrough. — April 11th. Electricity Department. Twelve months' supply of cables and meters. (March 30th.)

Sidmouth.—April 14th. Gas and Electricity Works. 100 tons of fuel oil for semi-Diesel engines. (See this issue.)

South Africa.—Johannesburg.—May 16th. Town Council. Switchgear and transformers. (B.X. 4284.)*
May 10th. South African Railways and Harbours. One electric passenger lift with dual control. (A.X. 6083.)*
May 18th. 6,600-V a.c. and 210-V d.c. switchgear. (B.X. 4294.)*

Southend-on-Sea.—April 30th. Corporation. One electrically-driven direct-coupled centrifugal pumping set for Eastern Valley pumping station Specifications, &c. (£2), from Mr. R. H. Dyer, borough engineer and surveyor.

Stoke-on-Trent.—May 9th. Electricity Department. One 12,500-kW turbo-alternator and condensing plant. (March 23rd.)

Uruguay.—Montevideo.—May 3rd. State Electricity Works. One 75-kW Diesel-engine generating set, with accessories and spares. (B.X. 4270.)*
May 21st. H. and l.p. armoured cables. (B.X. 4301.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Contracts Closed.

Belgium.—Belgian, Dutch, German, French, Czecho-Slovakian, and British (the British Insulated and Helsby Cables, Ltd., Prescot) firms submitted tenders recently for 2,500 metres of l.p. armoured cable to the municipal authorities of Schaerbeek, Brussels. The tenders ranged from 163,400 to 198,800 fr., the lowest being that of a Belgian concern, the Société des Cableries et Corderies du Hainaut, of Dour.

Bexhill.—Electricity Committee.
1,500-kW Bruce Peebles convertor (£4,428).—A. Reyrolle and Co., Ltd. (Accepted.)
Cable.—(£259), W. T. Henley's Telegraph Works Co., Ltd.; (£896), Enfield Cable Works, Ltd.; (£566), British Insulated Cables, Ltd.; and (£1,581), Greenwich Cable Works, Ltd. (Recommended.)

Brighton.—Tramways Committee. Recommended:—
Trolley wire (£177).—British Insulated Cables, Ltd.
Rails (£539).—Bolckow, Vaughan & Co., Ltd.
Lamps (£120).—Poynter, Griffiths & Co., Ltd.
Steel tires (£210).—Andrew Brown & Co.
Brake blocks (£144).—J. Every.
Lighting Committee. Accepted:—
Tank for Southwick works (£120).—Richardsons, Westgarth & Co., Ltd.

Bury (Lancs.).—Town Council. Accepted:—
50-ton travelling crane for the electricity works.—Herbert Morris, Ltd.

Cheltenham.—Electricity Committee. Accepted:—
Cables in connection with bulk supply scheme (£11,007).—Hackbridge Cable Co., Ltd.
Transformers (£3,189).—Hackbridge Electric Construction Co., Ltd.
Switchgear (£15,734).—A. Reyrolle & Co., Ltd.

Chile.—Naval Commission. Accepted:—
Leclanché cells.—Edison Swan Electric Co., Ltd.

Glasgow.—Tramways Committee. Recommended:—
Equipment for new and reconstructed cars (£38,800).—English Electric Co., Ltd.
D.C.C. wire.—Enfield Cable Works, Ltd.
Trolley wire.—R. Johnson & Nephew.
Special work.—Hadfield's, Ltd., and Edgar Allen & Co., Ltd.
Watching and Lighting Committee. Recommended:—
Supply of cables in connection with the street lighting of part of the new Glasgow to Edinburgh road (£486).—Enfield Cable Works, Ltd.

Ilford.—Electricity Committee. Recommended:—
Two 1,500-kW auto-synchronous motor generators (£8,060).—Crompton-Parkinson, Ltd.
Switchgear (£560).—General Electric Co., Ltd.
Trailer (£123).—F. G. Smith & Sons.

London.—Western Union Telegraph Co. of America.
Manufacture and laying of a "loaded" cable between Newfoundland and the Azores.—Telegraph Construction & Maintenance Co., Ltd.

Plymouth.—Electricity Committee. Accepted:—
Transformers.—British Electric Transformer Co., Ltd., and Metropolitan-Vickers Electrical Co., Ltd.
Meters, a.c. and d.c., ordinary and pre-payment.—Ferranti, Ltd.
Meters, d.c., ordinary.—Fox & Offord.
Cables.—British Insulated Cables, Ltd.

Radlett.—Accepted—
Installing electric light at the Parish Church.—Messrs. Giffen.

Rugby.—Town Council. Accepted:—
2,000-kVA transformer and switchgear for the Union Street sub-station, at £1,154.—British Thomson-Houston Co., Ltd.

York.—Electricity Committee. Accepted:—
Cable (£3,060).—Callender's Cable & Construction Co., Ltd.

Forthcoming Events.

Institute of Marine Engineers.—Tuesday, April 10th. The Institute, 85-88, The Minories, E. 6.30 p.m. "The Practical Value of the Report of the Heat Engine and Boiler Trials Committee." Mr. G. J. Wells.

Institution of Engineers-in-Charge.—Wednesday, April 11th. St. Bride Institute, Bride Lane, E.C. 7.30 p.m. "Modern Welding Processes." Mr. W. E. Quine.

Electrical Power Engineers' Association, Northern Division.—Thursday, April 12th. Geographical Hall, Manchester. 7.45 p.m. "Pulverised Fuel." Mr. F. Nicholls.

Institution of Engineering Inspection.—Friday, April 13th. Royal Society of Arts, John Street, Adelphi, W.C. 7.30 p.m. "Low Temperature Carbonisation." Mr. B. P. Wilson.

Institution of Electrical Engineers (London Students' Section).—Friday, April 13th. Institution, London, W.C. 7 p.m. Address by the President, Mr. A. Page.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following:—

Derenco irons.
Scandinavia cable slings.
A brown Bakelite adaptor (Prov. Pat. 13098. J. B. Taunton).

Notes.

E.A.W. Activities.

About 50 members of the Leeds and West Riding Branch of the Electrical Association for Women visited the new Ferrybridge power station of the Yorkshire Electric Power Co. on March 26th The party, by the special invitation of Mr. W. B. Woodhouse, engineer and general manager, was given the opportunity for a very thorough inspection of the works, and the tour embraced all operations, from the weighing and unloading of coal on delivery to the turbine house and control room.

The South Wales and Monmouthshire Branch of the Association held its first annual meeting and luncheon at Cardiff on March 28th. Miss C. Haslett, director of the Association, in referring to the campaign which was being launched in order to obtain greater facilities for the use of electrical labour-saving appliances, and for the standardisation of plugs and sockets, said that they had already gained permission to appoint a representative on the B.E.S.A. Committee dealing with these matters. Mrs. Tyler, branch hon. secretary, said that there were now over 130 members on the books.

Members of the Manchester District Branch of the Association visited the Manchester showrooms of the Hotpoint Electric Appliance Co., Ltd., on March 29th, when a demonstration of electric cooking was given by Miss M. R. Rees.

B.E.S.A. Publication.

The British Standard Tables of Pipe Flanges (Gas and Water, for Land Use), No. 10, Part 1, 1928, recently published by the British Engineering Standards Association, with part 2 (Steam), published in 1926, completes the revision of the 1904 edition. Part 1 comprises the three tables, A, B and C, which deal with flanges for pipes, valves and fittings for gas and water. Dimensions are specified for pipes up to 72-in. nominal bore for working water pressures up to 50 lb., and up to 48-in. nominal bore for working water pressures up to 130 lb. and 175 lb. per sq. in. respectively, the gas flanges are for working pressures up to 30 lb. per sq. in. Copies of the tables may be obtained from the Publications Dept., British Engineering Standards Association, 28, Victoria Street, London, S.W.1, price 2s. 2d. post free.

Electric Propulsion of Ships.

In a paper he recently read before the Rugby Engineering Society, Mr. W. J. Belsey, M.I.N.A., dealt with the electric transmission of power for propelling ships. He emphasised the fact that practically all recent vessels, whether propelled by steam or internal combustion engines, depended on the reliability of electrical machinery for their operation, and machines on which the safety and running of the ship depended, such as steering gear, scavenge blowers, circulating and lubricating pumps, &c., were driven electrically. Therefore, if its reliability was accepted for those vital duties, why not for the main propulsion where the machinery was of large capacity and therefore much easier to insulate and make reliable than was the case with smaller electrical machines? He believed that there were very many types of vessel where electric transmission could be used with very great advantage on account of its extreme flexibility both in operation and in location.

Liquid Fuel from Coal.

At a recent meeting of the Diesel Engine Users' Association, Mr. David Brownlie read a paper on the above subject, in which he dealt in detail with its importance from a national standpoint, stating that the production of liquid fuel from bituminous coal and other carbonaceous material was a vital matter to those in Great Britain who were connected directly or indirectly with the development of the Diesel engine, either as stationary power plant or for locomotive purposes. Instead of selling British coal at ridiculous prices, it would become compulsory to treat the coal on scientific lines, including the production of liquid fuel. The author made a brief reference to some 30 of the more important low-temperature processes that at the present time actually had large scale plant in more or less continuous operation. An indication that the time was rapidly becoming ripe for low-temperature carbonisation was the remarkable advance made during the past few years in pulverised-fuel firing, the solid carbonised product from any process being eminently suitable for this method of furnace operation.

Commercial Vehicle Parade.

The twenty-second annual parade of commercial motor vehicles organised by the Commercial Motor Users' Association (Inc.) was held in London on March 31st. The parade is limited to teams of three vehicles, except in the electric vehicle class, the object being the encouragement of drivers to take a personal interest in the driving and condition of their vehicles, and to run them without accident. A silver challenge cup is awarded to the owners of the winning team, and another cup to the drivers; there is also an engineers' prize and a number of money prizes for drivers. The British Electrical Development Association (Inc.) co-operated with the C.M.U.A. again this year and nominated three special judges (Col. R. E. Crompton, C.B., Mr. A. C. Cramb, borough electrical engineer, Croydon, and Mr. A. E. McKenzie, borough electrical engineer, Wimbledon). The B.E.D.A. and the New York Electric Truck Association awarded a number of prizes for the best electric vehicles on parade. The number of vehicles on view totalled just short of 100; eight users entered 18 "electrics" as follows, the mileages recorded being those declared by the owners:—

Brown & Polson, Ltd.: One Edison, 65,000 miles; one Walker, 62,300 miles.

Carter, Paterson & Co., Ltd.: Three General Vehicle Co., 34,200, 15,500, and 39,700 miles.

Chloride Electrical Storage Co., Ltd.: One Walker, 60,100 miles.

Hackney Borough Council: Three Garrett, 15,400, 14,600, and 13,500 miles.

Hovis, Ltd.: Two Edison, 65,000 and 68,300 miles; one Walker, 70,900 miles.

London Wholesale Dairies, Ltd.: Two Edison, 158,000 and 150,000 miles; one Ransomes, 86,000 miles.

North Metropolitan Electric Power Supply Co.: One Victor, 1,900 miles.

Watney, Coombe, Reid & Co., Ltd.: Two "Orwell," 25,100 and 13,600 miles.

Carter, Paterson & Co., Ltd., secured the first prize.

Wireless for Explorers.

The Court Treatt expedition now on its way to Africa is to be in direct touch with London by wireless, for which purpose a small short-wave transmitting set is being designed by the Marconi Company. The region for which Major and Mrs. Court Treatt are making is a tract of 60,000 square miles of uninhabited country in the Western Sudan, whence they will send messages for which a London man will listen every night. The set to be used by the explorers will work on a wave-length of about 30 metres, and its power will be of the order of 20 watts to the anode of the single valve, supplied by a hand generator. A half-wave-length aerial, 15 metres long, is to be used.

International Congress on Illumination.

When the delegates from all over the world arrive in the United States in September for the first International Congress on Illumination ever held in that country, they are to be shown outstanding examples of American lighting progress, and the scientific and engineering work which has been responsible for them. Preceding the meetings of the Congress at Saranac Inn, N.Y., September 22nd-28th, there will be an inspection tour, during which seven American cities will be visited. The tour will end at Toronto, where the delegates will attend the twenty-second annual Convention of the Illuminating Engineering Society, September 17th-20th, inclusive. Everything in American lighting practice, from research to sales and service, will be made available for those desiring to become familiar with the work done on the Western Continent. The arrangements are being made by an Executive Committee, at the head of which is Mr. Julius Daniels, of the Edison Electric Illuminating Company, of Boston. The Congress will be held under the auspices of the Illuminating Engineering Society and the U.S. National Committee of the International Commission on Illumination.

Electricity and Gas Installations.

In a very useful little booklet on "The Electrical Fusion of Gas Pipes," by H. C. Widlake, A.M.I.E.E., electrical engineer to the Plymouth and Stonehouse Gas Light & Coke Co., some interesting examples are given of badly installed electricity and gas house systems, where the electric conduit or cable sheathing had been found in contact with the gas pipes, in some cases resulting in serious fusion of the gas pipes and the consequent leakage of gas. The object of the book is to supply the gas fitter with the necessary knowledge of electricity installations to enable him to identify the conditions which lead to trouble, or to prevent such conditions in connection with his own work. The requirements of the electricity installation as regards earthing are detailed, the various wiring systems in vogue are outlined, and the "ideal conditions" for gas and electricity installations are laid down. The booklet is published by Messrs. Walter King, Ltd., price 6d., but quantities may be obtained at reduced prices.

Michael Faraday's Relations.

In our issue of March 16th we mentioned the death of Mr. Barnabas Faraday, "a descendant of the famous Michael Faraday." This was an error, as Faraday had no children. Probably Mr. Barnabas Faraday was descended from Robert, Michael's brother.

Tram and 'Bus Costs.

In addressing the Manchester Rotary Club on March 29th on the subject of "Trams and 'Buses," Mr. Henry Mattinson, manager of the Manchester Corporation tramway undertaking, said that in Manchester it cost 0.21d. per seat mile to carry a passenger by tramcar, and 0.46d. per seat mile by 'bus, or roughly, as one to two. The more passengers carried by tramway the cheaper the operating costs, but that was not so in the case of the 'bus, in which the ratio of cost was constant and independent of the number of vehicles employed. The actual rates paid in Manchester on the track alone amounted to £68,000 per annum, and the value to the Highways Department of the road surface maintained by the Tramway Department was £50,000 per annum, so that in this respect alone the equivalent of a rate of 4½d. in the pound was given to the city. The bogie tramcar in Manchester carried 82 passengers seated and 12 standing, a total of 94. From two to three 'buses would be required to replace every such tramcar.

The Montefiore Prize Competition.

The Council of the Association des Ingénieurs électriciens sortis de l'Institut électrotechnique Montefiore, of Liége, has sent us particulars of the triennial prize competition named "Fondation George Montefiore," which will be held in 1929. The value of the prize will be 29,000 francs. Works must be received by April 30th, 1929, at the latest; the competition is international, and the prize will be awarded to the best *original* work on scientific progress and on progress in the technical applications of electricity in all branches. Alternatively, the jury may divide the prize-money, or may allocate one-third of it to one who is not a competitor, for a discovery of capital importance; or the prize may be withheld wholly or partially. Particulars can be obtained from the general secretary, M. L. Calmeau, rue St. Gilles, 31, Liége.

Appointments Vacant.

Assistant signal and telegraph engineer ($400 per month). Foreman telegraph mechanician ($375 per month +; $=2s. 4d.) for the Federated Malay States Government Railway. Technical assistant (£433) for the Edinburgh Corporation Electricity Department. Chief examiner of applications for patents and inventions in the Department of Industry and Commerce, Dublin. (See our advertisement pages to-day.)

Local Societies.

The annual supper and smoking concert of the Paisley Association of Electrical Engineers was held on March 28th. During the evening Mr. T. T. D. Geesin, who presided, outlined the activities of the Association during the past year, and called upon ex-Bailie Balderston to present the prizes to the apprentices who had gained awards for papers submitted to the Association.

Fuel and Industrial Costs.

A symposium on the subject of the influence of fuel on industrial costs was held by the Institute of Fuel on March 14th.

Sir PHILIP DAWSON, M.P., who presided, said that no public man could afford for a moment to overlook the very important part that fuel played in our national economy, and it was of the utmost importance that we should find means for the more efficient utilisation of that vital (and wasting) asset, fuel. We had nothing to fear in this country so far as the ability of our people, their genius to invent and develop processes and to put them into operation once they were developed, was concerned, from any other country in the world. But they needed the backing which those in other countries had, and it was necessary to emphasise the importance of backing them and of bringing about greater co-operation and co-ordination between those interested in the production and utilisation of fuel.

Professor K. NEVILLE MOSS, O.B.E., M.Sc., said the investing public was being buoyed up by the false hope that low-temperature carbonisation would provide an elusive palliative for the ills of the mining industry. There was too much chemical research, too little engineering research, and too little applied common-sense in connection with the treatment and utilisation of coal. The idea of buying inferior fuel for pulverised-fuel firing was sound, so long as the fuel could be obtained cheaply, because, apart from the small cost per therm, the thermal efficiency of the plant was, within limits, a little higher, owing to the greater radiant heat effect of incandescent ash particles. Further, a high ash-content prevented overheating of the refractory furnace linings, though on the other hand the disposal of the ash was costly.

Mr. JOHN BRUCE (Barking power station) said that, when estimating the value of a coal for steam generating purposes, the terms "efficiency" and "economy" were apt to become confused, and a system of definitely allocating the respective values of the various fuels became necessary. The additional expense incurred in the application of systematic fuel-purchasing methods was justified because definite operating conditions could be approximately tabulated for each fuel, the finer adjustments for the maintenance of efficient combustion conditions being determined when each particular fuel was being consumed. It seemed deplorable that, having in view the high efficiency for which power station plant could be designed, and at which it operated, we should still be purchasing raw material by methods which would not be tolerated in the purchase of other necessities. Bearing in mind the great increase in electricity generation which would be effected in the next few years, it was apparent that the purchase of coal on a commercially technical basis could not but aid very materially in the conservation of the nation's fuel resources. It was impossible in the case of a new plant to decide definitely at the outset the class of coal upon which the station would operate most economically and efficiently, and during the tuning-up period supplies should be obtained from different sources and in not too large quantities. The operating staff would then have every opportunity of determining the merits of each particular fuel. Such a study of available coals might often show that a low-priced coal, from the combustion of which an overall boiler-plant efficiency of 78 per cent. could be obtained, resulted in lower overall operating costs than a higher-priced coal producing an overall efficiency of, say, 80 per cent. At the generating station of the County of London Electric Supply Co. coals from every coalfield having shipping facilities on the East Coast had been tried out, and a study of the behaviour of such a wide range of coals under actual operating conditions had shown in an outstanding manner the advantages obtainable from two general classes. That did not mean, however, that the fuels rejected were unsuitable for steam generation, or were of less value than the others, when considered in connection with any other plant. Only a week or two ago he had visited a large power station in the Midlands operating very satisfactorily on a coal which had proved unsuitable for his company's type of plant and operating conditions. Ash, though objectionable from most points of view, had certain advantages which could not be overlooked. Sulphur and iron in the ash were harmful to both brick work and grate surface, but if the ash were clean there was a decided advantage in a fuel with an ash content of from 8 to 10 per cent. when high combustion-chamber and furnace temperatures were maintained and high-temperature pre-heated air was utilised. The ash formed a beneficial insulating layer on the grate surface between the point at which the actual live firebed was burning out and the point at which the grate surface left the combustion chamber. The liability of a fuel to spontaneous combustion was an important consideration with regard to reserve stocks which had to be stored, and he stressed the importance of stacking in a systematic manner, to a height consistent with the nature of the coal. The running stock at the County of London Company's station, which was not likely to remain in position for more than a month, was stacked to a height of 20 ft. The emergency stock consisted of approximately 40,000 tons of Scotch and Northumberland washed and unwashed slacks and smalls. The Scotch coals were stacked to a height of not more than 12 ft., and the Northumberland coals to not more than 10 ft.

Dry Cell Materials.

In an article on "Chemical Raw Materials for the Dry-cell Industry," by A. D. Camp, published in *Chemical and Metallurgical Engineering*, some interesting particulars are given concerning the ingredients of dry cells. Because manganese dioxide is a natural material purified only by mechanical processes, it is subject to wide variations of purity, depending on its source and treatment. The principal types all differ with regard to their chemical composition, physical condition, and depolarising power, and they often differ from lot to lot. A Philipsburg manganese with a 70 per cent. manganese-dioxide content is a better depolariser than Caucasian ore containing 86 per cent. of the oxide. Outside the depolarising power the fitness of a given ore for battery use is dependent upon the quality and kind of impurities present. Metallic iron accidentally mixed in the ore is very deleterious, and usually all shipments are passed over magnetic separators to ensure its removal. Other metallic elements, particularly copper, lead and silver in any soluble form, are active poisons in a dry cell, as they plate out on the zinc electrode and run the cell down by local short circuiting; their presence should be restricted therefore to mere traces. It has been the author's experience that the cheapest grades of artificial graphite are superior to any other variety, no matter how expensive. Commercial sal-ammoniac should contain less than 1 per cent. of ash or non-volatile residue, and under 0.75 per cent. of moisture. The best material is of domestic manufacture, but the imported, largely from Germany, is considerably cheaper, and is usually satisfactory. Fused and granular zinc-chloride are of about equal purity, but the latter kind is slightly dearer. Small amounts of mercuric chloride are dissolved in the electrolyte for the purpose of slightly amalgamating the inside surface of the zinc can, in order to minimise the effect of any harmful metallic impurities in the mix and to give a slightly higher voltage. It has been found that a blended wheat flour similar to the household brands makes the best dry-cell electrolytic paste.

A Chapel Lighting Installation.

An interesting lighting installation has recently been carried out at the Albion Congregational Chapel, Ashton-under-Lyne. The general scheme of lighting is by means of some twenty-two specially-designed ornamental hexagonal lanterns suspended from the roof to a position over the pews, from which a wide distribution of light is obtained. A silvered-glass reflector is fitted within each of these units to accommodate a 200-W gasfilled lamp, which provides a softly diffused light in a downward direction through a hinged door at the base fitted with a special type of diffusing glass. This lighting is supplemented by three 60-W lamps in each unit mounted above the reflectors, for the general illumination of the chapel through the morocco-pattern glass side panels of the lanterns. The metal work of the fittings is of non-corroding Manchester plate finished in dead black. Similar lanterns are installed in the chancel to illuminate the transepts, altar and choir stalls, while in the vestibule and porches six smaller types of similar design are equipped with 100-W and 60-W lamps respectively. The whole scheme is particularly pleasing, and since the units are totally enclosed, it is impossible, it is claimed, for their lighting efficiency to become impaired through interior dust accumulation. Doors are fitted at the base of each unit to enable lamp adjustments or replacements to be carried out expeditiously, and all fittings are wired on two circuits, which enables the reflector lighting to be extinguished during the sermon, while the auxiliary lights remain to give a softly diffused light of even intensity throughout the chapel. The electrical contractors for the installation were Messrs. W. J. Furse & Co., Ltd., while the General Electric Co., Ltd., made and supplied the Osram lamps and fittings.

Meter Engineers' Technical Association.

The second annual general meeting of the Meter Engineers' Technical Association was held on March 23rd, when the result of the ballot for the 1928-29 Council was declared. The following officers were elected at a subsequent meeting of the Council: President, Mr. Geo. D. Malcolm, meter superintendent, Stepney Electricity Department; vice-president, Mr. E. W. Hill; hon. secretary, Mr. A. Middleton; hon. treasurer, Mr. W. E. C. Alliss; hon. assistant secretary, Mr. F. C. Knowles; and editor, Mr. G. F. Shotter (late president). The total membership of the Association now stands at 275.

Conference of Public Lighting Engineers.

At the conference of the Association of Public Lighting Engineers, which is to be held at Sheffield from July 9th to 12th next, in addition to the address by the incoming President (Mr. J. F. Colquhoun, lighting engineer, Sheffield), papers will be read dealing with important problems of street lighting: "Non-Manual Control of Public Gas and Electric Lighting," by Mr. E. H. Horstmann and Mr. E. E. Sharp; "What the Public Want from a Street Lighting Department, as Pedestrians, as Motorists, as Ratepayers," by Councillor F. Thraves, Sheffield; and "Visibility," by Mr. J. M. Waldram. It is also hoped to have practical demonstrations of street lighting embodying the requirements of the British Standard Specification for Street Lighting recently issued by the British Engineering Standards Association.

Iron and Steel Institute.

The annual meeting of the Institute will be held at the Institution of Civil Engineers, Great George Street, Westminster, on May 3rd and 4th next, when some 17 papers will be presented for discussion. The annual dinner will be held at the Connaught Rooms, Great Queen Street, W.C., on May 3rd, at 7, for 7.30 p.m.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

The Electricity Committee of the Reigate Town Council has passed a resolution expressing regret that its recommendation that the salary of the electrical engineer be increased by £50 a year was not accepted by the Council, and that under the circumstances the question of making an honorarium to the electrical engineer be considered when the report on the new system of mains comes to hand.

At a special meeting of the Cannock Urban District Council on March 26th Mr. H. L. Thomson was appointed chief engineer and general manager of the electricity undertaking. There were 114 applicants for the post. Mr. Thomson was formerly resident engineer at Cannock for the Wolverhampton Corporation, who administered the Cannock undertaking under agreement.

Relative to the proposed retirement from the service of Mr. R. B. Maccall, secretary and treasurer of the Glasgow Corporation Electricity Department (age 69, service 54 years, average salary £959 15s. 3d. per annum), it was reported to the Committee on Superannuation that he had intimated that, in view of his state of health, he desired to exercise his option to retire, as at March 31st, and the committee recommended that he be granted a retiring allowance at the rate of £479 17s. 8d. per annum in terms of the scheme.

The York Corporation has approved the recommendation of the Electricity Committee to increase the salary of Mr. E. J. Nichols, city electrical engineer, from £750 to £900 a year.

We extend our congratulations to Mr. George Offor, who celebrated has 101st birthday on Friday last.

Mr. S. H. Fowles, deputy borough electrical engineer at Chesterfield, was on March 26th selected from 83 applicants to be electrical engineer to the Ilkley Urban District Council.

Mr. G. Mortimer, electrical engineer at Abertillery, was on March 26th appointed by Morecambe Town Council as the new borough electrical engineer at that town to succeed Mr. Jos. Boyce, who has been appointed to Grimsby.

It is reported that Mr. F. A. Szarvasy and Dr. H. F. Parshall have joined the board of the International Holding and Investment Co.

Mr. R. G. Purchase, of the staff of the electric lighting department of the Westland Works, Barwick, who is leaving to take up a position at Birmingham, has been presented by the directors with a cheque, and by the heads of departments with a silver cigarette case.

Mr. J. Henderson, M.C., B.Sc., A.M.I.E.E., is resigning from the staff of the Edinburgh Corporation Electricity Department, having been appointed to act as assistant district engineer, Central Scotland Area of the Central Electricity Board.

It is reported from New York that a Bill providing for a special medal of honour for Mr. T. A. Edison is being introduced into the United States Legislature.

We regret to record that owing to ill-health Mr. W. E. J. Heenan has been compelled under doctor's orders to tender his resignation of the post of borough electrical engineer at Bermondsey. He is suffering from a valvular affection of the heart with recent dilatation, and his nervous system as a result is in a most unstable condition. Mr. Heenan, who was appointed by the Council in April, 1905, asks that the Council will consider the question of adding a number of years to his length of service for superannuation purposes, and the Committee has requested the Finance Committee to favourably consider this point in dealing with the matter of his superannuation.

Obituary.—Mr. J. H. Gibson.—Mr. Joseph H. Gibson succumbed on March 27th to pneumonia after three days' illness at his residence in Dunston Road, Dunston-on-Tyne. Mr. Gibson was resident engineer at Dunston power station, where he had been employed for about 17 years, previous to which he was engaged at Carville power station. He was a native of South Shields, and had been in the employ of the County of Durham Electrical Power Distribution Co., Ltd., for about 24 years.

Dr. R. Pfeil.—The death is announced from Berlin, Germany, at the age of 64 years, of Dr. Ing. Robert Pfeil, one of the directors of the Siemens & Halske Co., and associated with that concern since 1892.

Sir W. B. Forwood.—We regret to record that Sir William Bower Forwood, of Liverpool, for many years chairman (and, indeed, one of the founders) of the Liverpool Overhead Railway Co., recently passed away at Funchal, Madeira, at the age of 88 years.

Mr. L. Lee Murray.—The death of Mr. L. Lee Murray, which we announced in our last issue, has made many the poorer through the loss of the friendship of a man of lovable nature who was ever ready to give a helping hand.

The late Mr. L. Lee Murray.

It was this side of his nature which led to his association with others during the war in their efforts to bring about better industrial relations between master and man. Mr. Murray was born in Australia, and was educated at Wesley

College, Melbourne. He graduated at Melbourne University, taking the diplomas of Master of Arts and Master of Civil Engineering. His first work on civil engineering was for the Victoria Railways. After gaining considerable experience, he took up the post of engineer-in-chief for Messrs. Bloomfield Bros., railway contractors, carrying out a considerable amount of work for them in the western district of Victoria. In 1892 he was appointed representative for Messrs. Siemens Bros. & Co., in Melbourne, carrying out electrical work for the firm, *i.e.*, the public street lighting of Launceston and the electric tramways of Hobart, and installing a large amount of machinery for mining work. In 1896 he moved to Sydney for the same company, and opened out considerable business for them in Australia from that centre. In 1900 he resigned his post in Australia and came to England, and was made manager of the outside department of the same concern until the end of the Boer War in 1902, when he proceeded to South Africa as manager to Siemens, Ltd. After some four years' work there he was recalled to England to take up the post of works manager of Siemens Bros'. Dynamo Works, in Stafford, where he remained until 1909. He was then offered the post of manager by Messrs. Bruce Peebles, of Edinburgh. Here he set to work and used much tact and diplomacy in the task of placing this concern on a satisfactory basis.

In 1913 he resigned from Messrs. Bruce Peebles and came to London, where he started a consulting practice, and at the same time acted for Messrs. Noyes Bros., of Melbourne and Sydney, as their representative in England, negotiating many large contracts on their behalf. Influenced by a spirit of true patriotism, he joined the Ministry of Munitions and rendered considerable service to the British Government, visiting the United States on their behalf to seek assistance and co-operation in the matter of munitions.

After the Great War he returned solely to his consulting work. It was during the period of the war that the first signs of illness appeared. He underwent a serious operation, and, happily, his wonderful strength and physique pulled him through. He then took a trip to South Africa to improve his health, but, unfortunately, whilst there he had to undergo a second operation, and from this he never satisfactorily recovered.

He was a member of the Institutions of Civil, Mechanical, and Electrical Engineers. On behalf of many of his friends we desire to tender to Mrs. Murray our sincere sympathy with her in her sore bereavement.

Amongst those present at the funeral, which took place on Friday last at Highgate Cemetery, were: Mr. and Mrs. Fraser, Messrs. H. W. Kolle, Theodore Petersen, T. B. Goodyer, H. Scholey, C. Hill, J. H. Bunting, D. Bremner; Mr. and Mrs. R. W. Giblin, Mr. E. Parkes, Mr. A. H. Walton and Miss Walton, Mr. F. B. Nathan, Mr. and Mrs. Harold Scales, Mr. A. F. Parris, Dr. J. Greve le Brun, Miss Bravant, Mr. H. D. Wilkinson, Mr. P. S. Tasker, Dr. J. F. Crowley, Mr. L. B. Atkinson, Mr. J. Ames, Mr. H. H. Couzens, Miss Morgan, and Captain Randall.

Sir Alexander Richardson.—We regret to record the death, which occurred on Friday last, at his residence at Clapham Park, at the age of 64 years, of Sir Alexander Richardson, who began his career in journalism on a daily paper in Glasgow. He studied shipbuilding and engineering affairs, became a contributor to *Engineering*, and in 1888 joined the editorial staff of that journal. In 1919 he succeeded Mr. B. A. Raworth as joint editor, and when Dr. Maw died he became editor. He retired in 1924. He was a very talented writer, editor, and author of books on subjects connected with engineering and allied industries. He was elected Coalition Member of Parliament in 1918.

Financial Section.

New Companies, Returns of Share Capital, Debenture Changes, Reports of Electrical Companies, Dividend Results, Transactions in Stocks and Shares.

New Companies Registered.

Frank Peasgood, Ltd.—Private company. Registered March 21st. Capital, £500 in £1 shares. Objects:—To adopt an agreement with F. Peasgood for the purchase of the business of an electrical and automobile engineer, contractor and manufacturer carried on by him. The subscribers (each with one share) are:—Frank Peasgood, Junr., 411, Holloway Road, N.7, electrical engineer; Frank Peasgood, 422, Holloway Road, N.7, hairdresser. Secretary: F. Peasgood, Junr. Registered office: 411, Holloway Road, N.7.

Indian Mica Supply Co., Ltd.—Particulars filed on March 22nd, pursuant to Section 274 of the Companies (Consolidation) Act. The company was incorporated in India. The British address is at 97, Queen Victoria Street, E.C.4, and M. Ray, 7, Carlton Road, Putney Hill, S.W., is authorised to accept service of process and notices on behalf of the company. The directors are:—M. Lal, R. K. Lal, and B. Lal, all of Calcutta.

Electric Lamp Service Co., Ltd.—Private company. Registered March 29th. Capital, £2,000 in £1 shares. Objects:—To enter into a contract with the Oslo Light Co., Ltd., of 39 and 41, Parker Street, Kingsway, W.C.2, to purchase and take over all the undertaking, property and assets, and all the debts, liabilities and engagements of their subsidiary concern carried on as the Electric Lamp Service Co., and to carry on the business of electricians, mechanical engineers, manufacturers and workers of, and dealers in, electric lamps, &c. The first directors are:—J. Thorn, 39, Parker Street, Kingsway, W.C.2; C. B. Liddell, 25, Cleveland Square, Hyde Park, W.2 (both permanent). Solicitors: Cottrell & Son, 10, Easy Row, Birmingham.

Tetley Brothers (1928), Ltd.—Private company. Registered March 26th. Capital, £4,000 in £1 shares. Objects:—To acquire the business now carried on at Floodgate Street, Birmingham, as "Tetley Brothers, Ltd.," and to carry on the business of manufacturers of screws, nails, rivets, springs and the like for machinery, guns, firearms, cycles, motors, aeroplanes, gas and water fittings, electrical fittings, wireless apparatus, &c. The first directors are:—A. H. Crane, 11, Park Avenue, Soho Hill, Handsworth, Birmingham (director of Crane Screw Co., Ltd.): Harriet S. Crane, of the same address; J. Taylor, 13, Crosbie Road, Harborne, Birmingham (director of Crane Screw Co., Ltd.). Qualification, 250 ordinary shares. Registered office: 46, Floodgate Street, Birmingham.

J. C. White & Co., Ltd.—Private company. Registered March 24th. Capital, £10,000 in £1 shares. To adopt an agreement with Emily A. White and to develop and turn to account the business of an electrician and manufacturer of, and dealer in, electrical supplies carried on by her at Manchester. The first directors are:—Mrs. E. A. White, 16, Westgate, Hale, Ches. (chairman); W. Knowles, 49, Bridge Street, Manchester, electrical fittings designer (permanent managing director); J. R. Lampard, Sankey Street Chambers, Warrington, accountant. Registered office: 49, Bridge Street, Manchester.

Terminus Radio (Victoria), Ltd.—Private company. Registered March 28th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of, and dealers in, wireless and electrical appliances, gramophones, insulated wires and cables, &c. The first directors are:—W. P. Edwards, "Fairmead," Gatehill, Northwood, Middlesex; J. E. Pearl, 34, Armitage Road, Golder's Green, Middlesex; A. Morris, 57, Woodstock Avenue, Golder's Green, Middlesex. The first two named shall be permanent. Secretary: F. H. Robinson. Registered office: 324, Vauxhall Bridge Road, Westminster, S.W.

Electramonic Co., Ltd.—Registered as a "public" company on March 26th, with a nominal capital of £100,000 in 150,000 participating preferred ordinary shares of 10s. each and 500,000 deferred ordinary shares of 1s. each. The objects are to adopt an agreement with W. H. Sayers and to carry on the business of importers, manufacturers, factors, &c., of gramophone records, musical instruments, television, electrical and wireless apparatus and accessories, proprietors of record producing studios, &c. The subscribers (each with one share) are:—V. E. Stevens, 17, Bedford Row, W.C.1, solicitor; J. D. Atherton, 37, Tavistock Square, W.C.1, solicitor; G. Lake, 55, Clarence Road, Wood Green, N.22, accountant; and four others. Registered office: 34-40, Ludgate Hill, E.C.2.

Afmah Signals, Ltd.—Private company. Registered March 28th. Capital, £1,000 in £1 shares. Objects:—To acquire the rights relative to a patent motor signal device known as the Afmah Electric Signal and Indicator and Patent Control Lever, owned by A. Harris, of the Afmah Motor Engineering Co., Higher Broughton, Manchester. The first directors are:—A. Harris, 38, Wellington Street East, Higher Broughton, manufacturing engineer (permanent managing director); H. Hawkes, "Valpré," Penn's Lane, Erdington, Birmingham, manufacturer. Registered office: 7, Brazennose Street, Manchester.

Beriton, Ltd.—Private company. Registered March 24th. Capital, £2,000 in 2,000 10 per cent. cumulative participating preference and 1,000 ordinary shares of 10s. each and 10,000 deferred shares of 1s. each. Objects:—To acquire the assets of Merchant Manufacturers Co., Ltd., in voluntary liquidation, including the trade mark "Beriton," and to carry on the business of general dealers in merchandise of all descriptions, and that of electrical and mechanical engineers, manufacturers of, and dealers in radio apparatus, &c. The first directors are:—J. W. Wilesmith, Orpen Road, Dyke Road, Brighton, accountant; A. James, Bracondale, near Gravesend, engineer; S. C. Kendall, "Berrybank," Isted Rise, Gravesend, electrician. J. W. Wilesmith is permanent governing director and chairman, subject to holding £50 shares. Registered office: 20, Bartlett's Buildings, Holborn Circus, E.C.1.

Lambert Laws, Ltd.—Private company. Registered March 29th. Capital, £2,000 in £1 shares. Objects:—To carry on the business of wholesale and retail dealers in electrical and radio goods and accessories, &c. The first directors are:—E. Lambert (managing director) and Mrs. E. M. Lambert, both of 15, Gloucester Place, Brighton. Qualification, £100 shares or stock. Registered office: 15, Gloucester Place, Brighton.

Imeson & Finch, Ltd.—Private company. Registered March 26th. Capital, £2,500 in £1 shares. Objects:—To acquire the business of electrical, mechanical and general engineers, machinists, smiths, founders, fitters, &c., carried on by Imeson & Finch at the Empress Works, Stockton-on-Tees. The permanent directors are:—A. Imeson, "The Briars," Saltburn-by-the-Sea, engineer; A. H. Finch, "Riftswood," Butt Lane, Old Eaglescliffe, Yarm, engineer. Qualification, 250 fully-paid shares. Secretary: A. Imeson. Registered office: Empress Works, St. John's Crossing, Stockton-on-Tees.

Official Returns of Electrical Companies.

Passmore, Gilhome & Co., Ltd.—Debenture dated March 6th, 1928, to secure £2,450, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: E. S. Cherry, "Elmerscroft," Elmers End Road, Anerley, S.E.

Colombo Electric Tramways and Lighting Co., Ltd.—Satisfaction in full on March 6th, 1928, of mortgage dated May 5th, 1902, securing £120,000 debenture stock.

Radions, Ltd.—J. H. Noble, C.A., of 3, York Street, Manchester, was appointed receiver and manager on March 16th, 1928, under powers contained in mortgage debentures dated October 26th, 1926, and March 8th, 1927.

Keighley Electrical Engineering Co., Ltd.—Second debenture dated March 16th, 1928, to secure £500, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: W. A. Benger and R. E. Hopkins, Lloyd's Bank Chambers, Bradford.

Electric Car and Accessories Co., Ltd.—A. V. Chetland, of 45, Racton Road, Fulham, S.W.6, ceased to act as receiver on March 14th, 1928.

Central Electric Development Co., Ltd.—Capital, £2,000 in 500 preference and 1,500 ordinary shares of £1 each. Return dated January 14th, 1928. 1,500 ordinary and 160 preference shares taken up. £1,560 paid on 160 preference and 1,400 ordinary shares. £100 considered as paid on 100 ordinary shares. Mortgages and charges, nil.

Townlea Electrical Co., Ltd.—Capital, £1,000 in 300 preference shares and 700 ordinary shares of £1 each. Return dated January 16th, 1928. 500 ordinary shares taken up. £500 considered as paid. Mortgages and charges, nil.

Pickvance, Ltd.—Capital, £5,000 in 2,000 preference and 3,000 ordinary shares of £1 each. Return dated December 30th, 1927. 1,002 ordinary and 600 preference shares taken up. £650 paid on 200 ordinary and 450 preference shares. £952 considered as paid on the remainder. Mortgages and charges, £2,000.

Lancashire Telephone Systems, Ltd.—Capital, £10,000 in 5,000 preference and 5,000 ordinary shares of £1 each. Return dated December 20th, 1927. 500 preference and 3,330 ordinary shares taken up. £3,517 10s. paid (being £1 per share on 3,205 ordinary and 10s. per share on 125 ordinary and 500 preference). Mortgages and charges nil.

Electric Advertising Clocks, Ltd.—Capital, £36,000 in 30,000 ordinary shares of £1 each and 120,000 deferred shares of 1s. each. Return dated December 31st, 1927. 27,492 ordinary and 120,000 deferred shares taken up. £8,600 paid (being 10s. per share on 17,200 ordinary shares). £16,292 considered as paid on 10,292 ordinary and 120,000 deferred shares. Mortgages and charges nil.

Scott Insulated Wire Co., Ltd.—Capital, £14,000 in 4,000 preference and 10,000 ordinary shares of £1 each. Return dated December 28th, 1927. 2,075 preference and 10,000 ordinary shares taken up. £12,075 paid. Mortgages and charges nil.

Duff Brothers, Ltd.—Capital, £2,100 in 2,000 "A" ordinary shares of 1s. each and 1,000 "B" and 1,000 "C" ordinary shares of £1 each. Return dated January 30th, 1928. All shares taken up. £2,098 paid. £2 in arrears. Mortgages and charges nil.

Townlea Electrical Co., Ltd.—Capital, £1,000 in 300 preference and 700 ordinary shares of £1 each. Return dated January 16th, 1928. 500 ordinary shares taken up. £500 considered as paid. Mortgages and charges nil.

Power and Traction Finance Co., Ltd.—Capital, £250,000 in £1 shares. Return dated January 14th, 1928. 6,002 shares taken up. £6,002 paid. Mortgages and charges nil.

City Notes.

County of London Electric Supply Co., Ltd.

This company's accounts were reviewed in our issue of March 23rd (p. 520). The annual meeting was held on March 27th, when Sir Harry Renwick, Bt., K.B.E. (chairman), who presided, said that the past year's progress had been very satisfactory. Among other things, the gross profit had increased by over £243,000, and the sales of energy by 102,597,527 kWh. There had been a saving of about £9,000 in fuel costs, largely due to bulk supplies. Unfortunately the burden of rates had increased by £21,558. The ordinary dividend included nearly ¼ per cent. from the outside areas in addition to the standard rate in respect of the inside areas. Progress with the second half of the first section of the Barking station had been generally satisfactory and a partial supply sufficient for their purposes should be available from the new plant by next autumn. The troubles experienced with the steam-raising plant and transmission mains were well on the way to satisfactory settlement. The economies in generation already effected at Barking were considerable, and when the present works were completed the station would be one of the most economical in the kingdom. They had been very busy with extensions to meet the needs of an unusually large number of additional consumers. The arrangements under the London Electricity (No. 1) Act, 1925, were now practically settled, and they were daily expecting the decision of the responsible authority as to the fixing of the standard price and other matters involved. Referring to the South-East England electricity scheme, the chairman said that the company found it necessary to make representations to the Central Electricity Board, and the objections made had been largely met in the amended scheme adopted by the Board. Both the Barking and the Wandsworth stations had been "selected" and various primary transmission mains were to radiate from Barking. The company had been successful in securing an Act extending its area and powers in Essex, and a scheme for the development of the new area was under consideration. The company was also extending its powers in the Epping district. In looking forward he had to admit that he could not see what the ultimate effect of the Electricity (Supply) Act, 1926, upon the company's business would be, but he had the greatest confidence in the Board and the Commissioners. Apart from those considerations, however, the general business of the company was still progressing. They had reduced their charges but they hoped that the consequent fall in revenue would be compensated for by new business. They had aimed at standardising rates throughout their area; that would enable them to facilitate the consideration of further concessions. After dealing with the mis-statement that charges for electricity were lower in New York than in London, Sir Harry said that they fully recognised the importance of the selling side of the business and they were doing everything in their power to encourage the use of electricity for all purposes. The position of the companies associated with them was all that could be desired. The total assets of the company and its associates amounted to £20,000,000, and their total gross revenue to over £3,000,000. Dealing with the question of national electricity supply, the chairman remarked upon the acceleration of progress during 1927 and considered that the conservative policy which had been pursued by many authorities might lead to a crisis as regarded the inadequacy of plant. He did not think, however, that the company could be accused of unpreparedness.

Marconi International Marine Communication Co., Ltd.

Mr. F. G. Kellaway presided at the annual meeting on March 30th, and in the course of his speech said that the absence of Senatore Marconi was due to ill-health. While he was supposed to be resting he was actually engaged on very important research. Dealing with the accounts (*vide* our last issue, p. 563), the chairman pointed out that the company had no prior charges, debentures or bank loan, and had £600,000 invested in Government securities. There had been important technical developments during the year, one of which was the decision of the Government to make the fitting of an auto

alarm device compulsory on all ships carrying between 50 and 200 passengers. They and the Radio Communication Co. had already received a large number of orders for the device. The direction finder, at first regarded as an expensive fad, was now being looked upon as a great economiser of time and money. It had been brought to such perfection that fog had lost its terror for the commander of a ship approaching land. In consequence of an Italian decree the company had had to form an Italian national company to carry on business in Italy. By the liquidation of the Argentine company affiliated to Marconi's Wireless Telegraph Co., Ltd., the company would re-enter into the possession of the Argentine maritime rights and would actively develop the wireless business. There had been a real improvement in shipping and shipbuilding, and the delivery of vessels for which wireless equipment was compulsory had risen by 100 per cent. in 1927. The chairman then dealt with the benefits which were accruing from the company's acquisition of the control of the Radio Communication Co., Ltd., and used this to illustrate the benefits to industry and the consumer of combination. Referring to the cable-wireless merger, Mr. Kellaway said that it was imperative that the external communications of the United Kingdom should be operated as one unit, and he mentioned what was being done in the way of co-ordination in the United States. In conclusion, he said that the company's net profit during the past three years had steadily progressed; in 1925 it was £118,979, in 1926 £126,132, and in 1927 £179,730. There were good grounds for believing that the progress would continue.

Newcastle-upon-Tyne Electric Supply Co., Ltd.

Mr. R. P. Sloan (chairman and managing director) presided at the annual meeting on March 27th, and in presenting the report and accounts (ELEC. REV., March 23rd, p. 520), said that all their anticipations of improvement had been fulfilled. The results were gratifying in view of the state of the coal industry. They had again had to meet a large increase of rates. The business of the company as a whole had steadily progressed; over 30,000 h.p. was connected up during the year, and much of this was represented by further supplies to domestic consumers. The sum transferred to reserve was double that of the preceding year, but while the amount of available profit would have permitted the payment of a higher dividend, the directors thought it advisable to pay only 6 per cent. and carry forward a substantially-increased balance. The issue of £770,000 in ordinary shares made in June last was greatly over-subscribed. The bulk of the capital expenditure (£169,056) was incurred in distribution and providing for supplies to domestic consumers. The domestic section of their business had been energetically developed, and during the year they had connected up 12,600 new consumers. To a great extent these were connected to existing networks; if they had concentrated on new areas the increase would have been much greater. Mr. Sloan then proceeded to outline the objects of the Bill which the Cleveland and Durham County Power Co. (an associate of the company) had deposited in Parliament. He said that the main proposal was to extend the company's area of supply so as to embrace a portion of the East Riding of Yorkshire, the cities of York and Ripon, the borough of Harrogate, and so much of the North Riding and the rural districts of Wensleydale and Barnard Castle as were not already included in its area. Portions of the West Riding were also included. Dealing with the prospects for the current year, the chairman said that the outlook was encouraging. At the beginning of the current year they had orders on hand for further supplies representing about 30,600 h.p., 20 per cent. more than a year earlier, and 5,000 h.p. of this had been connected up. The report and accounts were adopted, and subsequently the objects of the Cleveland and Durham Company's Bill were approved.

Kensington and Knightsbridge Electric Lighting Co., Ltd.

Presiding at the annual meeting on March 27th, Col. R. E. Crompton, C.B. (chairman) said that the company continued to make steady progress. The future could be looked forward to with confidence, as their showroom and other facilities and the keenness of the staff were constantly adding to the company's business. The figures on which the standard price was to be based had been agreed by the London County Council, but had not yet been formally approved by the Electricity Commissioners. Therefore, the shareholders could not yet be informed what, if any, additional benefit would result from the reductions of charges which had already been made. They believed that the remarkable increase in sales had been due to those reductions and to the company's deferred-payment system for appliances. There was to be a further substantial reduction as from the March meter readings, and possibly another later in the year. The average prices obtained per kWh during the past three years were as follows:—1925, 3.21d.; 1926, 3.03d.; and 1927, 2.77d. The programme of improvement commenced in 1922 had been practically completed, and as a result the transformation and distribution efficiency had been raised by 5½ per cent. The whole of the improvements had been financed by the company from within. They intended gradually to introduce an a.c. system, and although the change-over would be slow and costly, it would eventually lead to a further reduction in the cost of supply. During the past year the whole of their supply had been taken from the London Power Co., and the Management Committee of the Joint Companies which supervised the Wood Lane station ceased to operate in September last. The report and accounts were adopted, and afterwards a resolution was passed sanctioning the application of £5,500 of the reserves to the paying-up of ordinary shares for allotment to the directors as extra remuneration for their services in connection with the reorganisation of London electricity supply.

Shropshire, Worcestershire and Staffordshire Electric Power Co.

The net receipts for the year ended December 31st last were £276,448 (against £232,170 in 1926); to this is added £45,469 brought forward, making £321,917. After providing for administration expenses, rates and interest, there is a balance of £175,628. From this £50,000 is transferred to reserve, the preference dividend is paid, the "A" ordinary shares receive 8 per cent. (4 per cent. already paid), and the "B" ordinary shares 7 per cent., leaving £45,628 to be carried forward. A further 250,000 "A" ordinary shares have been issued at a premium of £48,438, which has been used for writing off capital expenses. The capital expenditure during the year was £374,135. Included in this is the acquisition of the assets of the Ludlow Electric Light Co., Ltd., the Bishops Castle Electric Light & Power Co., Ltd., the Clun Electric Supply, Ltd., and the Fladbury Electric Light & Power Co., Ltd. About 72 miles of overhead and underground cables were installed, bringing the total length to 423 miles; over 20 miles of service cable was laid; and 18 new sub-stations were put into service, making a total of 81. The number of consumers increased by 26 per cent., and the sales of energy by 14 per cent. Supplies have been made available in a number of additional districts. The Tewkesbury and Upton-on-Severn generating stations have been closed down, supplies now being afforded by the main stations. New showrooms have been opened in Redditch and Ludlow and the company's new offices at Mucklows Hill, Halesowen, have been occupied. The interconnection cable between the company's system and that of the Birmingham Corporation has been completed. Agreements have been entered into with the Cheltenham Corporation for a bulk supply, and with the West Gloucestershire Power Co. for the interchange of supplies. The first two 18,000-kW turbo-alternator sets at the Stourport station are now in operation, and a further 20,000-kW set is on order. The company is promoting a Bill providing for the increasing of its capital and the extension of its area of supply. Mr. C. Shirreff Hilton has resigned from the board. Meeting: April 12th.

Ericsson Telephones, Ltd.

The annual meeting was held on March 28th, Mr. W. M. Crowe (chairman and managing director) presiding. In presenting the reports, the chairman referred to the death of Lt.-Col. P. W. d'Alton, and went on to say that the past year was one of the poorest ever experienced by the telephone industry. He thought, however, that conditions would improve; the orders in hand were considerably greater than a year ago, and the value of work in progress had nearly doubled. The company was taking its part in the conversion of telephones to automatic working, and its apparatus had been highly commended. He then dealt at some length with the world's telephone position, pointing out how much greater development had been in North America than in Europe. This country compared very unfavourably with other European countries and the Dominions. If America (or any other country which he had mentioned) was taken as a measure of telephone density, then the amount of work to be done in this country was prodigious. The quality of telephone service in Great Britain compared favourably with that of any other country. A live publicity campaign was necessary to advertise the many advantages offered by this cheapest and most useful of all means of communication. The telephone habit should be encouraged and the service should be looked upon as a necessity instead of as a luxury. The Telephone Development Association had already obtained good results, but it was handicapped by the fact that it was entirely unofficial and by insufficient funds to carry out the necessary country-wide publicity. Mr. Crowe then reviewed the accounts, and pointed out that the reduction in the net profit from £44,599 to £27,004 was largely due to the heavier depreciation of plant allowed. The balance-sheet included nothing for goodwill or patents, although their value and that of secret manufacturing processes was considerable.

Folkestone Electricity Supply Co., Ltd.

This company's report for 1927 was summarised in our last issue, p. 564. Speaking at the annual meeting on March 30th, the chairman (Alderman G. Spurgen, J.P.) referred to the death of Mr. F. E. Gripper and the appointment of Mr. F. Hall (the secretary) to the vacancy on the board thus created. After dealing with the accounts and results, the chairman said that the company was now using for revenue-earning purposes £58,725 which was paying no dividends. The directors accordingly proposed to make the share capital more nearly representative of the capital expended upon the undertaking by capitalising £35,000 of the reserve fund. That would be issued as a share bonus to the ordinary shareholders in the proportion of one new share to each four held. The new shares would rank *pari passu* with the existing shares as from the date of issue. Before the transaction could be carried out certain formalities had to be gone through. The directors were not ignoring the claims of the

consumers, and after the current meter readings reductions would be made in the charges. The cost of the concessions would be considerable, but the directors were relying on their own efforts to meet this. They were not relying upon the possibility of a bulk supply, which in any event would have but a small influence on production costs.

South London Electric Supply Corporation, Ltd.

The annual meeting was held on March 29th, Sir Harry Renwick, K.B.E. (chairman), presiding. In moving the adoption of the report and accounts, the chairman said that an unsatisfactory feature was the increase in local rates, which were a burden to all trading undertakings. The company was now taking the whole of its supply in bulk from the County of London Electric Supply Co., Ltd. The ordinary dividend totalled 8¼ per cent., which was practically the company's standard dividend; there still remained for settlement with the authorities a few questions of principle involved in the 1925 Act. He claimed that the past year's results were satisfactory in every way. Dealing with the balance sheet, the chairman said that the debenture stock (£130,000) was redeemed on March 16th, 1928. The Electricity (Supply) Act, 1926, would not greatly affect the company. The board and the boards of associated companies had secured amendments which made the Act far more workable than it was in its original state. The prospect for the current year was good, and the company could look forward to the future with confidence. In fact, the shareholders could regard their holdings as good as a trustee security. In thanking the staff, Sir Harry said that where it had been necessary to dispense with the services of any of their employés, owing to the change-over to full bulk supply, compensation had been paid on a liberal scale.

A. Reyrolle & Co., Ltd.

The profit for the year ended December 31st last, after providing for redemption of leases and depreciation, was £89,306, as compared with £83,351 in 1926. To this is added a net amount of £48,924 brought forward, making £138,230. The preference dividend is paid, and the ordinary dividend is maintained at 12½ per cent. The reserve for general purposes receives £25,000 (against £15,000) and a balance of £65,430 is carried forward. It is proposed that a sum of £1,000 shall be contributed to local charities. The capital expenditure during the year was £48,537; of this £30,694 represented new buildings, and the remainder new plant, machinery, &c. The output of the company's manufactures during the year was maintained at a satisfactory level. The increased volume of work and the greater size of contracts make it desirable to increase the cash resources of the company. It was proposed therefore to submit a resolution at the annual meeting on Wednesday last to provide for the creation of 100,000 additional shares of £1 each, raising the total capital to £500,000. The directors have under consideration the establishment of a staff pension fund.

Prospectus.

Electramonic Co., Ltd.—The formation of this company is recorded in our "New Companies Registered" section. Further information was contained in a prospectus published on Monday last announcing the issue of 150,000 8 per cent. cumulative participating preferred ordinary shares of 10s. each and 500,000 deferred ordinary shares of 1s. each. Of the latter 290,000, together with £12,500 in cash, are to be allotted to the vendors, and 60,000 are allotted fully paid, leaving 150,000 for public subscription, *i.e.*, one for each preferred ordinary share. The latter class is to receive 25 per cent. of the surplus profits after the payment of the 8 per cent. dividend, the remaining 75 per cent. being taken by the deferred ordinary shares. In a winding up the preferred ordinary shares are entitled to repayment before the deferred shares participate. The company is to make electrical reproducing gramophones, radio apparatus, and combinations of these. Inventions of Mr. W. H. Sayers, B.Sc., are being acquired, together with the business of the Unique Wireless Co., a freehold factory (subject to a mortgage) and West-End showrooms. The directors are Sir Philip Dawson, M.P. (chairman), Sir Alan H. Burgoyne, M.P., Mr. L. N. Tyrrell, Mr. H. C. Goodman (late of the British Thomson-Houston Co., Ltd.), and Mr. W. H. Sayers, B.Sc. (managing director).

British Aluminium Co., Ltd.

Lt.-Col. S. H. Pollen, C.M.G. (chairman) presided at the annual meeting on March 30th, and in presenting the report (*vide* our last issue, p. 564) said that the tonnage of aluminium delivered last year was the largest which the company had ever sold. A gratifying feature of the increase was that it covered a wider range of uses. The employment of the metal for electrical conductors showed large development. In each of the last two years the sales for that purpose had risen by 50 per cent. They looked forward to an increasing demand for aluminium for transmission cables throughout the world and particularly in connection with the schemes of the Central Electricity Board. The transmission lines for the Scottish Scheme were to be of steel-cored aluminium, and the company had secured the order for the metal. After dealing with other uses the chairman said that the growth of the demand had necessitated considerable plant extensions. The construction of the Lochaber hydro-electric works had made good progress. In conclusion he said that although the company had to contend with still lower prices and keen competition they looked forward with confidence to the future.

Brompton and Kensington Electricity Supply Co., Ltd.

The report for the year ended December 31st last states that the sales of energy increased from 6,867,875 to 7,579,261 kWh. After providing the statutory amounts for the sinking and contingency funds, and extinguishing a debit balance on the Brompton and Kensington Accessories Co., Ltd., the net revenue for the year was £43,359. It is proposed to pay a final ordinary dividend of 10.706d. per share, making up the standard dividend for the year (20.706d. per share). A balance of £12,557 is carried forward. Although the company is not yet connected with the London Power Co.'s mains, and consequently has not had the benefit of the "pooled" cost of consolidated generation, it has already made reductions in its charges in excess of its statutory obligations. Meeting: April 19th.

Salisbury Electric Light and Supply Co., Ltd.

After providing for taxation, debenture interest and depreciation, and adding the balance brought forward, the balance on the past year's working was £9,593. Of this, £2,000 has been transferred to reserve, a final dividend of 6 per cent., free of tax, is paid on the ordinary shares (making 10 per cent., tax free, for the year), and £93 is carried forward. The company has applied for a special order for the extension of its area of supply. The company has also formed the Wilton Electricity Supply Co., Ltd., to provide a supply in Wilton, and a Special Order has been applied for. The company will hold the shares of the Wilton Co. and supply it with energy in bulk. The capital of the company is to be increased by £50,000, and an issue of 25,000 ordinary shares will be made in May or June.

Windermere and District Electricity Supply Co., Ltd.

In the report for 1927 mention is made of the scheme for cancelling part of the arrears of preference dividend and the allotment to the holders of 7½ per cent. non-cumulative preference shares in lieu of the remainder. The new shares were fully paid up from the reserve. The profit for the year was £8,465, and sundry additions, including interest and dividends from the Keswick Electric Light Co. and £2,240 brought forward, make £11,574 available. From this are paid debenture interest, &c., £2,000 to depreciation reserve, £4,500 to reserve fund, and £250 is written off capital account for free-wiring. The full dividend is paid on the new 7½ per cent. preference shares, and 8 per cent. on the 6 per cent. cumulative preference shares to clear the balance of arrears. The Keswick Electric Light Co., Ltd., earned a gross profit of £3,304 during 1927.

Companies to be Struck off the Register.

The names of the undermentioned companies will be struck off the Register at the expiration of three months unless cause is shown to the contrary:—

A. & A. Electrical Co., Ltd.
Grosvenor Clark Electrical Co., Ltd.
International Electric Railways and Water Power Syndicate, Ltd.
Magnus Electrical Appliances, Ltd.
Swan Radio Co., Ltd.
Universal Wireless Supply Co., Ltd.
Wireless (Southampton), Ltd.

Potteries Electric Traction Co., Ltd.

Presenting the accounts at last week's annual meeting, Mr. R. S. Howley, C.B.E. (chairman), said that they hoped it would soon be possible to prepare the accounts in a form which would give more information with regard to the working of the omnibus side of the business. So long as the tramways were running it was impossible to distinguish between the different expenditures in the balance sheet. He referred to the agreement with the Stoke-on-Trent Corporation by which motor omnibuses were to be substituted for tramcars on all tramway routes in the city.

Llanelly and District Electric Supply Co., Ltd.

The profit for the past year (including £1,189 brought forward) is £43,652. The allocations include £13,500 to reserve and renewals accounts. While the preference dividend is paid, the directors consider it advisable to defer the resumption of the ordinary dividend on account of the state of local industries. A balance of £1,279 is carried forward.

Bath Electric Tramways, Ltd.

Speaking at the annual meeting last week, the chairman (Mr. E. H. R. Trenow) said that the directors had been able to increase the preferred ordinary dividend. They could look forward with confidence to the future. Bath had commenced to grow, the company's business was increasing, and the ratio of expenses to receipts had been reduced.

Jarrow and District Electric Traction Co., Ltd.

The total revenue for the year was £9,806, and after meeting all expenses and adding £1,724 brought forward, there is a balance of £1,202, which it is proposed to carry to the next account. Through running between the Tyne Dock, *via* the Market Place, South Shields, and the Pier Parade terminus ceased in July last upon the expiry of the agreement with the Corporation.

Newcastle and District Electric Lighting Co., Ltd.

Addressing the shareholders at the annual meeting on March 30th, the chairman (Col. F. R. Simpson) said that the past year's results were very satisfactory. There had been a steady increase in the demand and a large number of new consumers had been connected. The company had guaranteed £700 towards the fund for next year's North-East Coast Exhibition at Newcastle. The company's offices were to be removed to more adequate premises, in which there would be attractive showrooms. That should lead to an increase in receipts from domestic consumers.

Gateshead and District Tramways Co.

The revenue for 1927 increased by £2,485 to £128,097. After meeting expenses, including £10,000 for the renewal fund, there is a net profit of £24,595 (against £18,235 in 1926). A balance brought forward of £23,342 is added, making £47,937. It is proposed to pay an ordinary dividend of 10 per cent., as in the preceding year, and to carry forward £21,369. During the year portions of the tramway track on the Dunston and Teams routes were reconstructed. The meeting was held on Wednesday last.

Cable, Telephone and General Trust, Ltd.

Sir Alexander Roger (chairman), presiding at the annual meeting on March 26th, said that the issued capital at the end of 1927 was £446,442, the whole of which had been invested. The net revenue for the year was £12,250, and after paying the dividends on the preference shares a balance of £985 was carried forward. Less than one-tenth of the Trust's investments were in foreign concerns. During the year Mr. John Lee, C.B.E., and Mr. H. S. Bennett, A.M.I.E.E., had joined the board.

Stock Exchange Notices.

Dealings in the following have been specially allowed by the Committee under Rule 159:—

Underground Electric Railways Co. of London, Ltd.—2,350 ordinary shares of £1 each, fully paid, Nos. 5,068,879 to 5,071,228.

Midland Counties Electric Supply.—500,000 new ordinary shares of £1 each, issued at £1 4s. per share, partly-paid and fully-paid, Nos. 1,500,001 to 2,000,000.

Telegraph Construction and Maintenance Co., Ltd.

At an extraordinary meeting on March 29th a resolution adopting the new articles of association was passed. The chairman (the Earl of Selborne) mentioned that since the annual meeting on March 1st the company had received an order for the construction and laying of a new Transatlantic cable of a special loaded type for the Western Union Telegraph Co.

British Engine, Boiler and Electrical Insurance Co., Ltd.

The report for 1927 records the death of the company's chief engineer, Mr. Michael Longridge. It states that an interim dividend of 13s. per share was paid in June last, and it is proposed to transfer £20,000 to the pension fund and £10,000 to the contingency fund. A final dividend of 15s. per share is recommended and £12,240 will be carried forward.

Northern General Transport Co., Ltd.

From the profits of the past year £53,082 is allocated to renewals and £10,387 to reserve. The directors recommend a final dividend of 7½ per cent., making 10 per cent. for the year, as compared with 7 per cent. for 1926.

Richmond (Surrey) Electric Light and Power Co., Ltd.

A final dividend of 6 per cent. is recommended on the ordinary shares, making 10 per cent. for the year, against 9 per cent. for the preceding year.

Shanghai Electric Construction Co., Ltd.

The directors recommend a final dividend of 8 per cent., making 12 per cent. for the year, as compared with 10 per cent. for 1926.

German Companies.

The *Elektra Company*, Dresden, which is an investment company, reports net profits of 1,910,000 marks for 1927, as compared with 1,390,000 marks in the previous year. The dividend is maintained at 12 per cent.

The *Saxony Works, Light and Power Co.*, Niedersedlitz, proposes to pay a dividend of 7 per cent. on the ordinary shares out of net profits of 1,154,000 marks, as compared with 6 per cent. and 754,000 marks respectively in 1926.

The *Concordia Electricity Works Co.*, Dusseldorf, reports an increased turnover in 1927. The net profit was 263,000 marks, as against 221,000 marks in 1926, and the dividend is 6 per cent., as compared with 5 per cent.

The *Transradio Company for Wireless Oversea Traffic*, Berlin, states that the existing direct wireless communications were further developed in 1927, these applying to North and South America, the Dutch East Indies, China, and Japan. Direct communication with the Philippines was opened last August and working to Siam, Chile and Mexico is in prospect. The net profit was 1,387,000 marks, as compared with 1,388,000 marks in 1926, and the dividend remains at 8 per cent.

Stewarts & Lloyds, Ltd.

Speaking at the annual meeting last week, the chairman (Mr. A. C. Macdiarmid) said that the accounts showed a complete recovery from the effects of the coal stoppage. The sales of tubes exceeded the previous highest figure by over 33 per cent. The directors considered it wise to conserve the company's resources and accordingly the dividend was smaller than could have been paid. A new company had been formed in South Africa to deal with the company's business in the Union, and it was probable that arrangements would be made during the current year to form a similar company in Australia. In conclusion, the chairman said that the world's capacity for tube production was still in excess of the demand, and it was probable that a period of even lower prices might have to be faced, although the prospects of trade improvement were good.

Stocks and Shares.

Monday Evening.

Business started the week in a somewhat halting manner, and there was a certain amount of tiredness about, but sentiment veered round completely later on, and extreme activity was again the order. Considering the competition from the flood of new issues which have made their appearance during the last few days, and the close proximity of Easter, not to mention the Budget, the volume of business done each day is little short of extraordinary. There is hardly a section which has not participated in the general activity, and the sections devoted to electricity continue to receive their full share of attention. A newcomer this week was the no-par value shares of the Stock Exchange Mutual Subscription Fund, which were "introduced" at 20s., at which price they were eagerly sought after, over 500,000 shares changing hands within a few days. Dame Rumour hath it that this venture is in some remote way connected with the Epsom Downs!

Home Rails.

Undergrounds, after having been down to 24s. 4½d., firmed up to 25s. on the news that the company had obtained a substantial interest in the largest independent omnibus company operating in London. The 6 per cent. incomes also hardened to 118. It is mentioned in certain quarters that the proposed Underground new issue may take the form of debenture stock instead of shares as was generally imagined. Even if this were so, it would in the long run be to the benefit of the ordinary holders, as the earning power of the new money would without doubt show a substantial surplus over and above the interest and sinking fund charges, and the surplus would, of course, be available for ordinary share dividends. Both Metropolitans and Districts were good, the latter being no less than 2¼ points up at 75. The heavy railway market, although perhaps a little firmer for choice, was practically featureless.

Electricity Supply.

Practically without exception, lighting shares tended to ease off, and those which have been in the limelight recently, such as Metropolitans, Electric Supply, Urbans and Bournemouth and Pooles, were all a couple of shillings or so down. The whole market firmed up well later in the week, and as will be seen by our list of prices, changes have been on balance negligible. Every week seems to produce its special feature in the electricity market. Last week it was Isle of Thanets. This week it is North Wales Power ordinary which have been semi-moribund on the basis of 14s.-14s. 6d. for some time. Buying, which seems to emanate from the provinces, quickly hoisted the price to 17s. 6d. bid, a not inconsiderable rise in a few days. The Midland Counties new issue which was mentioned in this column last week as being on the tapis, duly made its appearance, and took the form of 500,000 ordinary shares offered to existing shareholders at 24s. on the basis of one new share for every three old. Dealings have started in the new nil paid, and the price is around 9d. premium. County of Londons were in demand at 35s. 6d. on the chairman's speech, which was of a most optimistic character. Whilst on this subject, it is understood that negotiations between the Bournemouth and Poole Company and the local corporations, for an extension of the company's tenure, have broken down, the corporations being unable to agree to the company's proposals. It is said that the Corporation Committee which is dealing with this matter is now endeavouring to arrive at a basis of values for the purpose of purchase. Still on the subject of the County group of companies, Richmonds were in demand at 36s. on the increased dividend (10 per cent. against 9 per cent.). Lancashires were active and higher at 30s., as were Newcastles at 27s. 3d., with the new ordinary 26s. 6d., both cum dividend. Isle of Thanets were inclined to be easier on the lack of anything definite in the way of confirmation of recent absorption rumours. The usual investment business took place in the shares and debentures of the London companies, concerning which there is nothing of particular interest to report.

Overseas Electrical Stocks.

The most active shares in foreign electrics were the $100 common shares of the Mexican Light and Power Company, which have been moving five points at a time and closed at

102½, a drop of some seven points on the week. Even at this figure they show a considerable rise since the beginning of the year, when they stood at 68. It is somewhat difficult to justify the present price for Mex. Lights from a study of the last published balance sheet. In common with the other stocks of what is known as the Belgo-Canadian group of public utilities, it stands at a price which would appear to discount prospects well ahead. Mex. Lights 7 per cent. preference at 84 just managed to maintain the previous week's rise, but the $5 second preference shares met with a fair amount of profit taking, and sagged to 60s. as a consequence. Kalgoorlies came into demand, and are now 9s. bid. There was inquiry for some of the Indian companies; Calcuttas were better and Cawnpores were marked up to 30s., with Madras 32s. East Africans were fairly active around 28s. There was more doing in Atlas Light and Power shares, with the 7 per cent. preference in demand at 22s. 6d. and the 6 per cent. debenture stock 105 x.d. The ordinary still continue to bump up against the 20s mark in spite of a considerable number of shares changing hands, from which it would seem that some of the people who got in at about 16s. a few months ago are cashing their profits. Monterey Railway "A" debenture stock changed hands up to 62, and "goes out" 61-6 in the official list. The "B" and "C" stocks were also better at 16½ and 4 respectively.

Tramways.

London United Tramways and London Suburban Traction junior stocks strengthened on the announcement that the Underground Company had obtained a large if not a controlling interest in the London Public Omnibus Company, by far the largest and practically the last of the "Pirates." It is fairly obvious that this deal will result in a considerable reduction in 'bus competition on the tramway routes, especially those of the Metropolitan Electric Tramways, as the Public 'buses have been a thorn in their side for many a long month. This deal is certainly a big step forward in the solution of the London traffic problem, and is distinctly a bull point for the tramway share. Quiet "put away" buying of Lancashire Transports continues, and they are now 9s. upward, with not a lot of shares about. Potteries ordinary have also been in demand, and are now practically 5s. The preference remain at 8s. 6d., and would appear the cheaper purchase of the two in view of the four years' arrears of dividend. The market think this share will pay to lock up, and certainly from the chairman's speech at the annual meeting the other day it does seem as if the company is at long last out of the wood. Turning to Overseas companies, British Columbia Electric Railway issues are again better. The deferred gained another 9½ points to its previous week's rise, and is now 232½ buyers for choice. The preferred followed suit, and at 173½ is 3½ up. Brazilian Traction common was in aggressive demand, and is now 236, at which price, on the basis of last year's rate of distribution, it gives the very handsome yield of £2 11s. 1d.! The preference is 195, a rise of no less than 20 points. Mexico Tramways common at 46 retained its previous week's rise, and is talked higher. Here, again, on the last published figures, and in view of the enormous arrears of bond interest which have got to be arranged for, it is not easy to see justification for the present price; and although the shares may continue to move on the up grade, holders must be prepared to see fairly violent fluctuations.

Cables.

There is nothing particularly exciting to report of telegraph and telephone shares. Marconis have been fluctuating between 62s. and 65s., and ended the week at 64s. Considerable numbers of shares changed hands each day, and on each reaction quickly encountered fresh support. The convertible debenture is 186, after having been somewhat lower, and the preference are also better at 105s. International shares touched as high as 44s. on the meeting. Canadian Marconis were again vigorously taken in hand from the other side, and at one time were 33s., from which level they subsequently sagged to 31s. In the Submarine Cable Group, Eastern Extensions further advanced to 20, as did Westerns, and Eastern Telegraphs topped the double century mark after having been a couple of points or so lower. United River Plate shares lost a fraction of their recent rise at 11¼. Globe ordinary were heard a lot of, and were a good market at 21. Taking it all round, there was not a lot doing, but dealers in this market prophesy a recrudescence of speculative interest after the holidays.

Manufacturing.

Electrical equipment shares were fairly active; General Electrics were up to 36s. 9d. on dividend hopes, but as the report does not appear until the middle of July, this seems a little premature. Electric Constructions were a shilling up at 27s., and there was a little interest taken in Brush ordinary round 29s. English Electric, both ordinary and preference, retained their previous week's rise, but were very little in evidence, whilst Metropolitan-Vickers continued to sag away, and are now at 30s. x.d. The recent rise in Babcock & Wilcox resulted in a certain amount of profit taking which caused the price to relapse to 71s. Cable-making shares produced no feature, and were practically in every case unchanged. About the best spot was Telegraph Construction ordinary, which went ahead on contract announcements, and finished at 26½, as against 23 less than a fortnight ago.

Share List of Electrical Companies.

	Nom.	Dividend. 1926.	Dividend. 1927.	Price April 2. 1928.	Rise or fall.	Yield. p.c.
Home Electricity Companies.						
Bournemouth and Poole	£1	14†	—	71/-	—	3 18 10
Brompton Ordinary	£1	8⅜	—	26/-	—	5 7 8
Charing Cross Corporation	£1	8½	8½	26/6xd	—	5 5 8
do. do. 4½% Pref.	£1	4½	4½	17/6	—	5 2 10
Chelsea	£1	8¾	8¾	26/-	—	5 7 8
City of London	£1	10	10	30/-xd	—	4 13 4
do. do. 6% Pref.	£1	6	6	23/-xd	—	5 4 4
Clyde Valley	£1	8	8	34/-	—	4 14 2
County of London	£1	7½	7½	35/6	+6d.	4 4 6
do. do. 6% Pref.	£1	6	6	23/-	—	5 4 4
Edmundsons' Ordinary	£1	10	—	67/6	—	2 19 2
do. 7% Pref.	£1	7	7	25/6	—	5 9 10
Elec. Supply Corporation	£1	11	—	52/-	—2/6	4 4 7
Kensington Ordinary	£1	8	8	26/-	—	5 7 8
Lancs. Light and Power	£1	7½	—	30/-	—	5 0 0
London Electric	£1	8½	8½	25/6	—	5 9 10
do. do. 6% Pref.	£5	6	6	5½	—	5 8 2
Metropolitan	£1	8	9	45/-	—2/-	4 0 0
do. 4½% Pref.	£1	4½	4½	17/6	—	5 2 10
Midland Counties	£1	6	6½	26/-xd	—6d.	5 0 0
Newcastle-on-Tyne Ordinary	£1	5	6	27/6	+1/-	4 7 3
do. 5% Pref.	£1	5	5	18/9	—	5 6 8
do. 7% Pref.	£1	7	7	26/-	—	5 7 8
Notting Hill 6% Pref.	£10	6	6	10½	—	5 11 7
North Met. Elec. 6% Pref.	£1	6	6	23/-	—	5 4 4
St. James' and Pall Mall	£5	8	8	26/6	—	5 5 8
South London	£1	8½	8½	26/-	—	5 7 8
South Metropolitan Pref.	£1	7	7	1½	—	6 8 0
Urban Ordinary	£1	7	—	50/-	—2/6	5 12 0
do. 6% Pref.	£1	6	6	1⅛	—	5 13 0
Westminster Ordinary	£1	8½	8½	29/-	—	5 7 8
Whitehall Elec. Invst. 7½% Pref.	£1	7½	7½	21/7½xd	—	6 18 9
Yorkshire Elec.	£1	8	8	29/6	—	4 15 7
Home Rails.						
Central London Ord. Assented	Stock	4	4	74½	—	5 7 5
Metropolitan	,,	3	3	67½	+½	4 8 11
do. District	,,	9½	4	75	+2½	5 6 8
Underground Electric	£1	1½	5	25/-	+6d.	4 0 0
do. do. Income	Bonds	6	6	118	+2	5 1
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	99½	—1	6 0 8
do Def.	,,	1½	1½	24½	+¼	6 1 10
Automatic Telephone	£1	10	10	46/3xd	+9d.	4 6 6
Chili Telephone	£5	6	—	7⅞	—	*3 18 8
Eastern Extension	£10	10	10	20	+½	*5 0 0
Eastern Tel. Ord.	Stock	10	10	204	+4	*5 0 0
Globe Tel. and T. Ord.	£10	10	10	21	—	*4 15 3
do. do. Pref.	£10	6	6	10½	—	5 17 1
Great Northern Tel.	£10	20	—	39½	+½	5 1 2
Indo-European	£25	10	—	40	—	*5 0 0
Marconi	10/-	5	—	64/-	+3d.	3 2 6
Marconi-Marine	£1	8⅜	12½	43/-	+1/6	5 16 3
Oriental Telephone Ord.	£1	12	—	52/6	—	*4 11 7
United R. Plate Tel.	£5	8	8	11¼	+¼	*3 11 11
Western Telegraph	£10	10	10	20xd	+½	*5 0 0
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref.	£5	5½	5½	9⅜	—	7 6 8
do. do. 2nd Pref.	£5	6	6	9½	—	7 17 4
do. do. 5% Deb.	Stock	5	5	78½	—	6 7 5
British Electric Traction Def. Ord.	,,	—	—	520	—	... ...
do. do. 8% Pref. Ord.	,,	8	—	194½	—	6 8 6
Brazil Traction	100	6	—	236	+15	*2 11 1
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	94½	—	5 5 10
do. do. Preferred	,,	6¼	6¼	173½	+3½	*3 12 1
do. do. Deferred	,,	8	8	232½	+9½	*3 8 9
do. do. Deb.	,,	4¼	4¼	81½xd	—	5 4 4
London & Sub. Trac. 5% Pref.	£1	Nil	Nil	8/6	—	... ...
London United Tram Deb.	Stock	4	4	57½	—	6 19 2
Mexico Trams, 5% Bonds	—	5	5	82	+1	6 5 1
Mexican Light Common	100	Nil	Nil	102½	—7	... ...
do. 7% Pref.	100	Nil	7	84	—	8 6 6
do. 1st Bonds	—	5	5	82½	—	6 6 2
Yorkshire (West Riding)	£1	Nil	Nil	7/6	—	... ...
Manufacturing Companies.						
Babcock & Wilcox	£1	13	—	70/6	—1/6	3 13 9
British Aluminium Ord.	£1	10	10	47/6	—	*4 4 2
British Elec. Transformer Pref.	£1	7	7	19/-	—	7 7 4
British Insulated Ord.	£1	15	15	4¼	—	3 12 8
Brush Ord.	£1	10	—	29/-	—	6 17 11
Callenders	£1	15	—	4⅜	—⅛	3 8 2
do. 6½% Pref.	£1	6½	6½	23/-	—	5 9 5
Crompton Parkinson Pref. Ord.	£1	—	—	17/6	—	... ...
Edison-Swan	£1	10	10	10/-	—	4 0 0
do. 5% Deb.	Stock	5	5	90	—	5 11 0
Electric Construction	£1	7½	—	27/-	+1/-	5 11 1
Enfield Cable Pref.	£1	7½	7½	26/3	—	5 14 8
English Electric	£1	Nil	Nil	9/-	—	... ...
do. do. Pref.	£1	3	Nil	12/6	—	... ...
Gen. Elec. Pref.	£1	6½	6½	24/-	—	5 8 4
do. Ord.	£1	7½	—	36/9	+9d.	4 7 1
Henley	£1	25	—	53	—	4 9 0
do. 4½% Pref.	£5	4½	4½	4½	—	5 6 0
India-Rubber	£1	Nil	Nil	13/9	+1/3	... ...
Johnson & Phillips	£1	12½	—	53/9	—	4 12 7
Met.-Vickers Ord.	£1	8	6	30/-xd	—1/-	4 0 0
do. Pref.	£2	8	8	28xd	—	5 1 11
Siemens Ord.	£1	7½	—	29/-	—	5 3 5
Telegraph Construction	£12	10	10	26½	+1	*4 10 11

* Dividends paid free of Income Tax.
† 4% of which was Tax Free.

Economic Conditions in Belgium.

The Progress of Electrification.

THE Department of Overseas Trade has published (through the Stationery Office, 4s. net) a report on the economic situation in Belgium in 1927 by Mr. J. Picton Bagge, Commercial Secretary in Brussels. In the course of his introduction, Mr. Bagge says that by a united effort the crisis following the stabilisation of the currency has been successfully survived, and Belgium is to-day in a healthy convalescent state, in spite of certain weak spots in the economic organism, such as the coal-mining industry. The policy which Belgium is following in order to regain full prosperity is all-embracing; it is at once financial, industrial and commercial. It comprises, moreover, economic equipment, transport facilities, technical education, development of natural resources at home and in the Congo, the improvement of international economic relations by treaty, and social welfare. After reviewing the financial policy which has been pursued, Mr. Bagge refers to the Public Works Committee which was set up to study the question of canals, the creation of barrages for hydro-electric purposes, the "rationalisation" of electricity and transport facilities, and other matters. The policy to be pursued regarding the rationalisation of electricity has not yet been defined, but the impetus given by the consideration of the question doubtless helped to bring about the agreement recently reached by an important group of power companies. The Government has been seconded in its efforts by private initiative, which has signified its activity by a renunciation of individualism. Cartels and trusts have sprung up on all sides. The necessity for reducing production costs by amalgamation, by rationalisation of production, by specialisation of factories, by the combination of technical resources, and organisation for sales purposes has been fully recognised. The conclusion is reached that Belgium's prospects are distinctly favourable. British export trade with Belgium is still hampered by high prices, and the purchasing power is restricted by the special taxation imposed for four years.

Electric Light and Power.

The report states that the rapid development of the use of electricity, which has been so remarkable in recent years, continued at an increased rate during 1927. One reason for this is the industrial stability brought about by the settlement of the currency question, while a great deal of the development is due to the education of the public by the supply companies and to the introduction, in some districts, of installations paid for by instalments. Good progress has been made in the province of Limbourg, where the system supplies energy to the great Campine coalfield. Similar progress has been made in the province of Antwerp. A new central station is to be erected at Schelle to meet the increasing demand, which showed a rise of 13 per cent. in 1927. Throughout the Campine the provincial Government is carrying on active propaganda with a view to inducing the inhabitants to install electric lighting. Farmers are realising, in view of the shortage of labour, the advantages and economies of electricity. In Brabant 247 out of 346 communes have electric power, and a further development is planned with the object of connecting up the rural districts. Progress has also been good in Namur and Eastern Flanders. At the end of 1926 the Belgian light and power companies had plant with a capacity of 780,000 kW, as compared with 630,000 kW at the close of 1925. The output rose from 790 to 925 million kWh, and the length of lines from 17,410 km. to 21,673 km. In addition, the municipal undertakings of Brussels, Ghent and Liége owned 50,000 kW of plant, and their output rose from 65 million kWh in 1925 to 78 million kWh in 1926. Moreover, the large colliery and metallurgical concerns produce an increasing amount of electricity, and their plant is estimated to have an aggregate capacity of 700,000 kW. Company reports show that power units are yearly growing in size, and that a centralisation of power stations and the interconnection of systems is being realised—all with a view to economy in production and improved distribution. The before-mentioned Public Works Committee recommended in its report the formation of a co-operative association to co-ordinate the production and distribution of power from the thermal stations and the proposed hydro-electric stations in the Ardennes and on the Meuse. There was a proposal to replace the existing 250 stations by five large stations, thereby bringing about by 1935 a reduction of the coal consumed by about a half for a doubled production of energy. In December last twelve of the big companies formed a cartel. This has as its objects the influencing of the formation of regional groupings of producers and eventually consumers; to promote the erection of large central stations; to organise the interchange of energy, &c.

The Radio Industry.

No direct reference is made in the report to the Belgian electrical industry, but attention is given to a branch of it—that dealing with radio apparatus. It is considered that the slow development in this industry is due to the inadequate broadcasting service which at present consists of small stations in Brussels and Antwerp. It is estimated that there are from 30,000 to 40,000 crystal sets and from 60,000 to 70,000 valve sets in use. There is no trade control in the country, and if the few firms which handle foreign apparatus are not well established, price-cutting often destroys the market for particular articles. One concern holds all the Marconi licences, which it re-issues to local manufacturers on a six-months' contract basis. Importers are placed on the same basis as manufacturers. There are many important Belgian firms with a large output, and a number of small firms turn out a few sets per month. The period of cheap wireless supplies has now passed, and retailers can command almost their own price, subject to competition. Owing to the development of flat-residence, receiving sets with frame aerials are in good demand, as are also portable sets. The majority of the better known French sets are on the market at competitive prices. American and British sets are sold regularly, but as a rule the sets of British origin (with the exception of portable sets, which are selling well) are still about 50 per cent. higher than the competing products, and are often not suitable for local conditions, for anything less than a four-valve set cannot take the stations on which Belgian listeners greatly rely. Loud speakers, however, and certain component parts of British origin have very successful sales. Ebonite supplies come chiefly from France, and in smaller quantities from Germany.

Communications.

During 1927 the placing of telegraph lines underground proceeded. There was a satisfactory increase in the number of telephone subscribers—from 130,398 on October 31st, 1926, to 145,325 a year later—and the number of exchanges rose from 382 to 399. A considerable amount of line work was done during the year. The automatic system is said to have made great progress. There are now four automatic exchanges in Brussels, while a fifth is almost completed. By next year the whole of the Brussels system will be converted, and there will then be eight 10,000-line exchanges. The system is being extended to the whole of Antwerp and to other large towns. Telephonic communication has now been established with a number of countries.

In October last the Government inaugurated its long-distance international "Belradio" station, which now accepts messages for the Congo, the Dutch Indies, Japan, Australia, the Philippine Islands, and America. At the receiving station, Liedekerke, a low-power short-wave transmitting equipment is being established for use when atmospheric conditions and traffic permit.

General.

In the section of the report which deals with agriculture it is stated that official forecasts indicate that within three or four years the smallest village in Belgium will be served with electric power. From 70 to 80 per cent. of the villagers take advantage of the service immediately it becomes available. On small farms dairy machinery and household appliances are electrically driven, and on the big farms electricity is used wherever possible for harvesting and other operations in order to make up for the shortage of labour.

The development of export trade, which is of fundamental importance to Belgium, has received, and continues to receive, the unremitting attention of the Government. Various organisations have been instituted for the purpose, and these include credit facility commissions for home and foreign trade, bodies for the collection and distribution of information, and a body similar in character to the Federation of British Industries.

There are no fewer than eight official bodies dealing with various aspects of foreign trade. One that has proved of great assistance to the larger manufacturing firms is the Commission du Ducroire, which is the counterpart of the Export Credits Guarantee Department of our Department of Overseas Trade. This Commission was authorised to give guarantees up to a total of 250 million fr. for a maximum period of three years. Up to September last guarantees amounted to about 170 million fr. Long- and medium-term credits are also afforded by the Société Nationale du Crédit a l'Industrie for both home and foreign trade. Another organisation which watches over foreign trade is a committee of business men, known as the Comité National du Commerce Extérieur, acting under the auspices of the Ministry of Foreign Affairs. The Comité Permanent de l'Exportation studies all matters concerning foreign trade, and is a means of bringing interested firms together for the exchange of information and experience.

An appendix to the report deals with conditions in the Grand Duchy of Luxemburg. In this it is reported that a Bill for approving an agreement between the Government and certain Luxemburg metallurgical works for the supply of electricity, in view of the general electrification of the Grand Duchy, was voted by the Chamber of Deputies on June 30th, and became law on the same day. A Bill for approving another agreement for the construction and operation of the electrical distribution system was laid before the Chamber in November and voted on December 16th.

Belgium's Foreign Electrical Trade.

THE Belgian Government now publishes monthly statistics of the country's foreign trade in considerable detail, and with the publication of the December issue it is possible to survey the import and export trade in electrical machinery and apparatus during the past two years. Belgium's imports of dynamo-electric machinery are declining, while her exports are expanding. Of telegraph and telephone apparatus her exports are four times as large as in 1925, while her imports of such goods are comparatively small, although they showed an increase in 1927. There is still a large quantity of unspecified electrical apparatus purchased abroad, but it is diminishing. Below are given the weights of electrical goods imported and exported in 1926 and 1927, with a note of any increase or decrease :—

Imports.

	1926. Thous. kg.	1927. Thous. kg.	Inc. or dec. Thous. kg.
Dynamo-electric machines—			
Total	3,430	2,595	− 835
From France	1,160	832	− 328
,, Germany	835	655	− 180
,, Sweden	465	221	− 244
,, United States	217	116	− 101
,, Switzerland	205	318	+ 113
Dry batteries—			
Total	221	143	− 78
From France	109	21	− 88
,, Denmark	66	93	+ 27
,, Germany	25	57	+ 32
Accumulators and plates—			
Total	320	213	− 107
From United States	146	53	− 93
,, Great Britain	36	17	− 19
,, France	75	28	− 47
,, Germany	31	21	− 10
Cables, submarine and underground—			
Total	3,312	491	−2,821
From Germany	2,795	393	−2,402
,, Holland	241	46	− 195
,, France	140	*	—
Insulated wire and cable, other—			
Total	517	435	− 82
From Germany	245	303	+ 58
,, France	58	43	− 15
,, Holland	96	33	− 63
Carbons for electrical purposes—			
Total	369	346	− 23
From Germany	140	116	− 24
,, United States	152	148	− 4
Insulators of porcelain, glass, &c.—			
Total	860	472	− 388
From Germany	190	108	− 82
,, France	548	324	− 224
Insulating tubes, not metal covered—			
Total	19	13	— 6
From Germany	9	7	− 2
,, Switzerland	5	3	− 2
Insulating tubes, other, with junction boxes, &c.—			
Total	118	139	+ 21
From Germany	95	123	+ 28
Metal-filament lamps—			
Gas-filled (mainly from Holland)	*	37	—
Vacuum, total	*	65	—
From Germany	*	12	—
,, Hungary	*	10	—
,, Holland	*	36	—
Wireless valves—			
Total	*	5	—
Measuring instruments and parts—			
Total	265	277	+ 12
From Germany	98	78	− 20
,, France	68	39	− 29
,, Switzerland	74	85	+ 11
Telegraph and telephone apparatus—			
Total	87	138	+ 51
From Germany	7	29	+ 22
,, France	55	49	− 6
,, Great Britain	16	25	+ 9
Electrical and electro-technical apparatus and parts not elsewhere specified—			
Total	2,389	1,871	− 518
From France	708	588	− 120
,, Germany	708	662	− 46
,, United States	430	158	− 272
,, Holland	179	150	− 29
,, Great Britain	96	70	− 26

Exports.

	1926. Thous. kg.	1927. Thous. kg.	Inc. or dec. Thous. kg.
Dynamo-electric machines—			
Total	1,927	3,064	+1,137
To Belgian Congo	444	550	+ 106
,, Argentina	336	139	− 197
,, Brazil	123	159	+ 36
,, Great Britain	209	549	+ 340
,, Holland	114	213	+ 99
Dry batteries—			
Total	47	88	+ 41
To Greece	11	4	− 7
,, Holland	20	50	+ 30
,, Great Britain	11	32	+ 21
Accumulators and plates—			
Total	404	657	+ 253
To Belgian Congo	10	9	− 1
,, Argentina	215	288	+ 73
,, Spain	40	26	− 14
,, Holland	65	46	− 19
Insulators of porcelain, glass, &c.—			
Total	164	99	− 65
To Belgian Congo	31	36	+ 5
,, France	74	26	− 48
Cables, submarine and underground—			
Total	3,350	4,839	+1,489
To Belgian Congo	150	210	+ 60
,, Germany	447	696	+ 249
,, Argentina	66	*	—
,, Great Britain	1,609	1,470	− 139
,, Holland	155	487	+ 332
,, Siam	520	6	− 514
Insulated wire and cable—			
Total	2,517	2,719	+ 202
To Germany	103	118	+ 15
,, Belgian Congo	115	114	− 1
,, Brazil	260	192	− 68
,, Great Britain	1,017	647	− 370
,, Holland	238	342	+ 104
,, Argentina	79	35	− 44
Insulating tubes—			
Total	371	446	+ 75
To Germany	65	4	− 61
,, Egypt	150	167	+ 17
,, Greece	47	63	+ 16
Metal filament lamps of all kinds—			
Total	39	75	+ 36
To Congo	5	3	− 2
,, Great Britain	11	21	+ 10
Measuring instruments and parts: meters—			
Total	103	27	− 76
Telegraph and telephone apparatus—			
Total	1,732	2,585	+ 853
To China	121	33	− 88
,, Spain	677	1,045	+ 368
,, Australia	95	99	+ 4
,, France	68	75	+ 7
,, Italy	72	89	+ 17
,, Norway	69	72	+ 3
,, Holland	88	91	+ 3
,, Switzerland	199	64	− 135
Electrical and electro-technical apparatus and parts not elsewhere specified—			
Total	941	966	+ 25
To Belgian Congo	24	40	+ 16
,, Germany	26	46	+ 20
,, Egypt	77	165	+ 88
,, France	130	80	− 50
,, Holland	62	78	+ 16
,, Syria	135	28	− 107
,, Siam	46	44	− 2
,, Great Britain	18	9	− 9

*Not specified.

Large Vertical Alternators.

Three 13,330-kVA water-wheel alternators recently built by the Metropolitan-Vickers Electrical Co., Ltd., are claimed to be the largest produced in this country.

THREE large vertical alternators, each having a normal rating of 13,330 kVA, have recently been built by the Metropolitan-Vickers Electrical Co., Ltd., for a new large hydro-electric station on the Maipo River in the high Andes in Chile, and together with the water turbines which have been constructed by Messrs. Escher, Wyss & Co., of Zurich, they form the initial equipment of the station, which is owned by the Compania Hidro-Electrica Volcan of Santiago. The plant is to supplement the existing electricity supply, which by means of a 110,000-V overhead system, is given in bulk to undertakings in the Santiago and Valparaiso districts for lighting and industrial power services, and also for tramways and main-line railways. The site of the new station is about forty miles south-east of Santiago, and is some 4,250 feet above sea level. The available water supply is at a normal head of 670 feet. The water turbines are of the Pelton wheel type, each unit having a capacity of 18,600 h.p. with a water supply of 1,870 gal. per sec. at the normal head.

The generators, fig. 1, are rated at 13,330 kVA at a normal voltage of 12,000, 3-phase, 50 periods, 0.9 lagging P.F. In addition the machines are capable of operating satisfactorily over long periods at 10,800 V and normal full-load current, or at 13,200 V and normal full-load kVA. Rise of temperature is guaranteed at not more than 50 deg. C. on normal output, with an inlet air temperature of 40 deg. C., and at an altitude of 4,250 feet; the equivalent rise at sea level would be 48.5 deg. C. The guaranteed efficiency of the machines under normal conditions is 95.25 per cent.

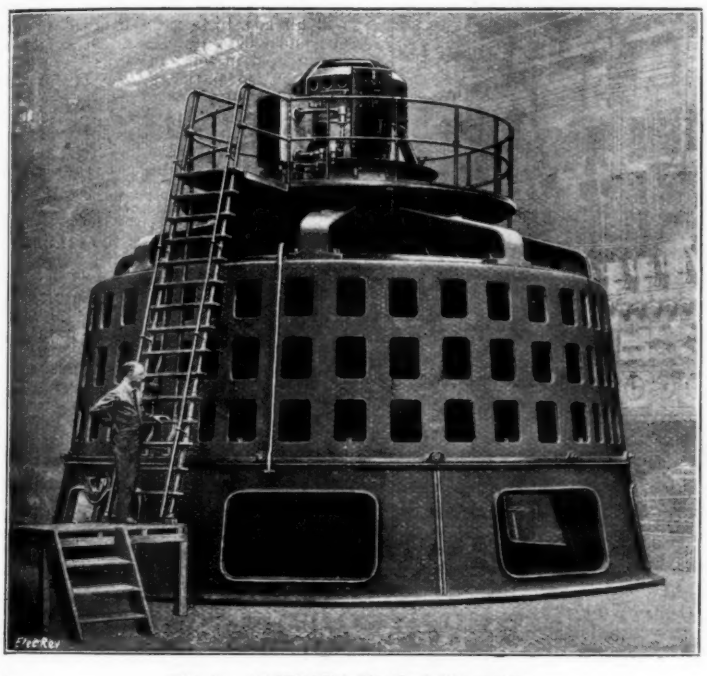


Fig. 1.—13,330-kVA Vertical Alternator.

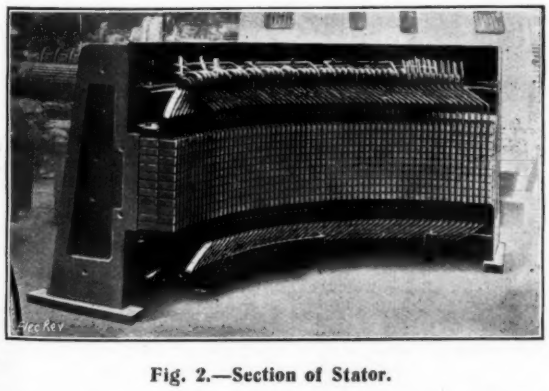


Fig. 2.—Section of Stator.

The stator of each machine is built up in four sections to facilitate transport, each section being shipped separately with its own part of the core assembled and the winding in position, except for the coils bridging the joints. One stator section thus assembled, but with the greater part of the air baffles removed to show the windings, is shown in fig. 2. The yoke assembled stands 6 ft. 8 in. high, 21 ft. 3 in. in diameter, and weighs 25 tons. The stator winding is of the two-layer diamond-coil type; all the coils are identical and completely formed and insulated before being placed in the slots.

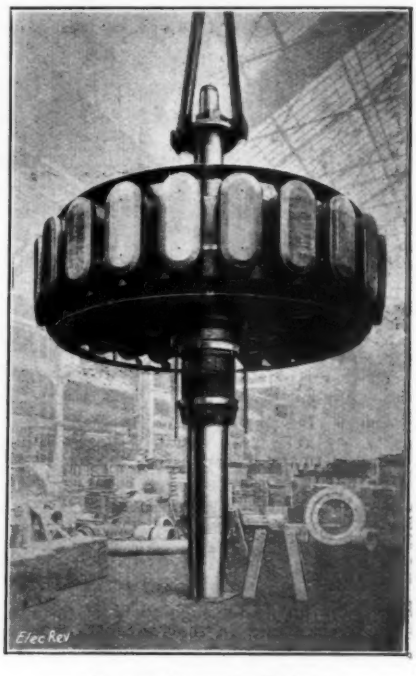


Fig. 3.—Alternator Rotor.

The rotor spider consists of two cast-steel wheels, each about 11 ft. 6 in. in diameter, 15 in. in thickness, and weighing 12½ tons. The wheels were cast with a solid web to avoid local shrinkage stresses, suitable openings for ventilation being afterwards machined in the web of each wheel. The 24 poles are built up of heavy-gauge stampings clamped under hydraulic pressure between cast-steel end plates. Each pole, weighing just over 15 cwt. with its coil, is attached to the spider by a dovetailed projection fitting in a corresponding slot machined in the periphery of the wheels. The design of dovetailed joints for this purpose has been the subject of extensive and thorough investigation, as a result of which a standard dovetail profile has been devised, securing maximum uniform strength at all points of the dovetail in both pole and wheel.

The rotor shaft is an annealed carbon-steel forging of 21 ft. length, 21 in. maximum diameter, and about 8¼ tons weight. It was bored throughout its length for purposes of microscopic inspection of the interior, the bore being subsequently used to carry the leads from the rotor to the slip rings through the thrust bearing and the upper guide bearing. One of the rotors completely assembled is shown in fig. 3.

The entire weight of the rotor, together with the exciter and the runner of the water turbine, totalling 75 tons in all, is carried on the upper bearing bracket by means of the thrust bearing which is mounted in it. The oil supply to the guide-bearings is delivered by a pump which runs submerged in the sump of the lower guide bearing. Sight lubricators are provided and an alarm system is installed to give warning by means of a Klaxon horn in the event of the oil supply failing to either bearing. Thermometers are placed in the thrust bearing and in the two guide bearings.

The ventilation of the machines is arranged on a simple radial system. Cooling air is taken in at the bottom by the action of fans mounted on the rotor, and after passing through the various parts is discharged through radial ducts in the stator core. The total circulation of cooling air as shown by test is approximately 90,000 cu. ft. per minute. Each alternator, with its exciter, is 15 ft. 7 in. high.

The total weight of each alternator is approximately 128 tons, of which 31 tons represents the electrical sheet steel in the magnetic circuits and 8 tons the copper used in the windings.

A New Oil Purifier.

Transformer-oil purifying apparatus has been produced in which, it is claimed, there is no absorption of oxygen or any other gas by the oil.

THE purification of transformer oil is becoming more and more important with the development of high-pressure transmission schemes, and this fact is made evident by the clauses which are appearing in specifications issued in connection with large contracts for h.p. equipment.

A disadvantage of the ordinary centrifugal oil purifier is that oil from the centrifuge is discharged into air. Furthermore, owing to the high speed of the rotating element, the oil is discharged in the form of a very fine film which is reduced to a fine spray when it strikes the stationary covers. Tests have shown that under these conditions the oil takes up oxygen to the point of its maximum solubility for its temperature at the time very rapidly. It is obvious that when such apparatus is used in conjunction with conservator-type transformers the main object of the latter cannot be fully achieved. An effort was made to overcome the difficulty by causing the oil from the centrifuge to be discharged into a gas other than oxygen, but while this method greatly reduced the oxygen content, there were still gas bubbles to be contended with.

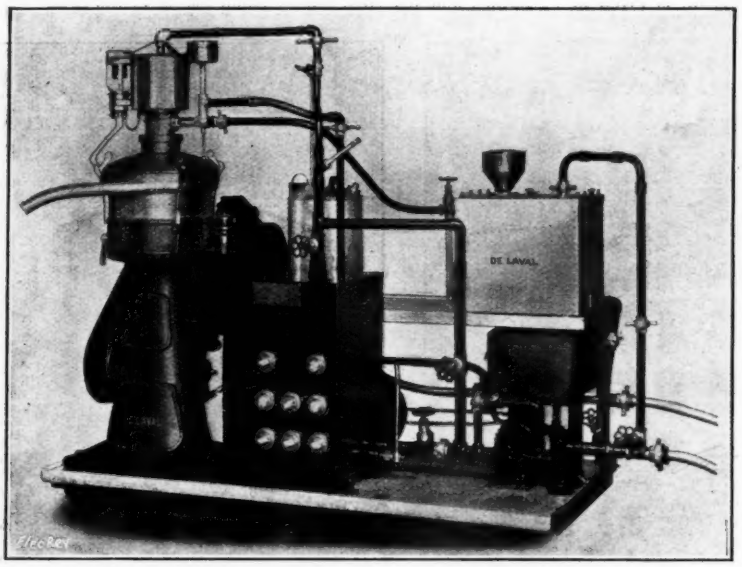


Fig. 1.—Non-Aerating Oil-Purifying Equipment.

Enterprise in America has resulted in the De Laval non-aerating equipment by which, it is claimed, the problem is fully solved. Our attention was drawn to this development by the announcement that two De Laval outfits are being, or have been, supplied for the new Perak hydro-electric scheme, and we learn from the producers in this country, Messrs. Alfa-Laval Co., Ltd., that a few are already in operation in Europe and about 100 have been sold in America.

The main feature of the new equipment is that the oil is discharged directly into oil without in any way coming into contact with air or any gas. This is rendered possible by a fairly simple modification of the ordinary centrifuge apparatus, and reference to fig. 2, a sectional view of the bowl and covers of the new equipment, will give an idea of its constructional details. In this machine, as in the makers' standard oil purifier, the oil is split up into a large number of thin films between clarifying cones, and on issuing from these the purified oil passes upwards through a special all-copper bellow neck bearing from which it is delivered to the oil outlet hose. Due to the centrifugal pressure generated in the bowl, the oil is discharged under a pressure of about 15 lb. per sq. in., and this pressure is maintained by means of a special dead-weight valve which only lifts at a predetermined pressure. The water and dirt are thrown into the sediment pockets at the periphery of the bowl, where they are retained. Under these conditions it is claimed that the oil passes through the apparatus without drawing in or adding gases at any part of the system. By means of a special sight glass at the oil outlet the oil can be examined at any time to see that it is free from air bubbles.

Fig. 1 shows one of the two oil-purifying outfits which were built to the special requirements of Messrs. Rendel, Palmer and Tritton for the Perak hydro-electric undertaking. This consists of a type-600 non-aerating centrifuge driven by a 3-h.p. motor; electrically driven gear pumps for pumping the oil to and from the purifier; a special 12-kW heater of very low-rating elements; a filling-in tank which enables the necessary oil to be added to fill initially the purifying equipment and the connecting hoses; and, among other auxiliaries, float tanks for controlling the oil inlet and outlet. The ordinary capacity of the purifier is about 450 gal. per hour, but when the machine is used as non-aerating equipment this figure is reduced to 340 gal. per hour. When filling-in conservator-type transformers, the oil supplied will already have been exposed to the air, and will contain as much oxygen as it can hold in solution; thus there is no objection to purifying the oil at this stage in an ordinary open-type centrifuge, and in order to allow advantage to be taken of the higher capacity of the machine it is furnished with conversion parts. These should also prove useful when dealing with switch or lubricating oils. Naturally, when used with the non-aerating equipment the machine cannot be assembled for the continuous discharge of water, but when used as an ordinary centrifuge it may be provided with a water seal to permit such discharge. Special means are provided for displacing all the air from the machine, pipework and hose connections before the oil valves on the transformer are opened out.

The standard De Laval conservator-type transformer-oil purifier is built in one size only, and as a portable unit. Its rated capacity is up to 450 gal. per hour, an average figure for producing efficient oil (40 kV testing strength or better), using the British standard gap with one passage through the machine. In service the capacity will vary somewhat, according to the condition of the oil being hydrated, while a higher dielectric reading will also usually be obtained.

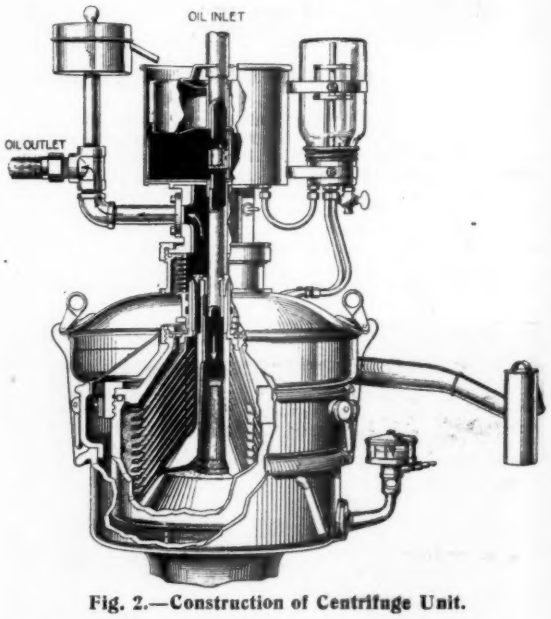


Fig. 2.—Construction of Centrifuge Unit.

We are indebted to Messrs. Alfa-Laval Co., Ltd., for the accompanying illustrations.

New Swiss Companies.

Among the concerns recently organised in Switzerland are the Gesellschaft Alpha Werkstatte für Elektrische und Mechanische Construktionen, Nidau, and the Compagnie des Lampes d'Eclairage et de T.S.F., Lausanne.

Geared Electrical Equipment.

Some Interesting Features of the Products of the London Electric Firm.

During a recent visit to the works of the London Electric Firm, which is situated at Croydon, on the Brighton Road, a number of the firm's products were inspected, and the following notes relating to some of these may prove of interest.

It seems that the undertaking has made a strong point of transmission gearing, with the result that the present manufactures nearly all involve special treatment in this direction.

Probably the principal products of the company are those concerned with searchlight and signalling apparatus. A very interesting example of such equipment is illustrated in fig. 1. This is a 90-cm. projector of the pattern used on cruisers. A feature is its very precise and elaborate elevating gear; a certain and definite number of degrees is represented by each turn of the handle. The barrel is constructed absolutely light-tight. In addition to the local hand control, distant control is arranged for, the equipment for this being housed in the base. This involves a reduction of as much as 90 to 1, resulting in a back lash considerably less than the half degree allowed. The lantern is mounted on roller trunnions carried by balancing rails. Features of a similar projector, a 60-cm. pattern for destroyer use, are the special de-clutching gear for the hand and distant controls, and universal joints for the transmission on the turning gear. The main bearings are equipped with leather washers to prevent the ingress of dirt. An interesting point is the method of carrying the supply cables to the lamp. The central vertical shaft of the control gear in the base is hollow and provided with side entry bushes at the top and bottom. The gear-boxes are generally made of gun-metal, but aluminium alloys are used in special cases. Ball bearings are used throughout for the larger projectors, and a ball-race takes the weight at the central vertical bearing.

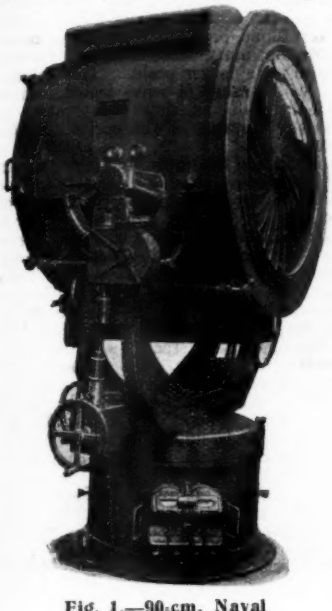


Fig. 1.—90-cm. Naval Projector.

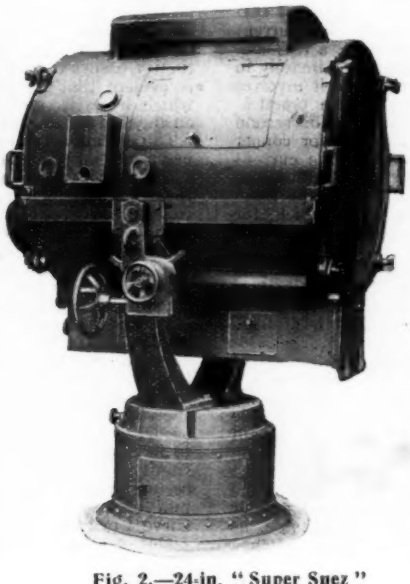


Fig. 2.—24-in. "Super Suez" Projector.

Much attention has been given by the firm to meeting the somewhat exacting demands of the Suez Canal Company; these call for a broad flat beam to illuminate the buoys on either side of the waterway, which must be capable of being darkened in the centre through an angle of 5 to 6 deg. when a vessel approaches in the opposite direction. An ingenious split-reflector device provides this condition. It consists of two halves of a parabola-ellipse mirror, which, in the normal position are placed to a give a broad beam. The two halves are hinged at the middle, and by turning the outsides slightly back two separate beams are provided, with the dark centre. Fig. 2 shows a "Suez Canal" projector.

An interesting range of smaller projectors is included in the manufactures. One is a 10-in. signalling lamp arranged with elevating gear for use when signalling to aeroplanes.

Another attractive production is a range of pilot-house projectors; these are designed for mounting on the roof of the cabin, with the lever apparatus for hand operation projecting downwards. Projectors for kinema studios form still another line of manufacture in searchlight apparatus. These are mounted on a frame base about 8 or 10 feet high, and a centre stem elevates the lamp for a couple of feet or so. The lamp has a positive rotating carbon for ensuring a uniform crater and special arrangements for its conversion for floodlighting. An auxiliary beam is supplied from the top of the lamp and results, it is claimed, in a shadowless "flood." It is interesting to note that the kinema automatic lamp is made on the premises, including the tiny control motor, and is provided with the non-disengaging feature.

Resistances made for the current control of the searchlights include one constructed with corrugated strip; it is believed to be unique. The strip is mounted on porcelain insulators carried on a simple framework. The material is very easily rated.

An entirely different line from the manufacture of searchlights is that of a range of worm reducing gears for operation with small motors. Fig. 3 shows a double-worm-reduction gearing seen running at the works. The worm is of special high-grade steel; it runs in ball journal bearings and is also fitted with ball-thrusts. A simple but effective method of lubrication is worth recording. The gearing is partially immersed in oil. The lubricant is lifted from the bath by the fast wheel and thrown on to a metal splash bar immediately above; a wire from this carries the oil to the high-speed bearings.

Precision worm winches form another interesting line of manufacture. An example observed was one designed to lift half a ton. It has a high efficiency, is very easy to wind and is provided with a machine-cut worm and wheel.

Contact direction suspension gear for street lighting fittings and the like is a speciality of the firm. A turn back from the up winding limit either automatically transfers the weight from the winding rope to the suspension gear or from this back to the rope, as the case may be; this is brought about by a simple arrangement of alternate retaining notches and "by-passes," and a set of guide teeth on the fixed portion of the gear, for receiving a suspension pin or clip on the movable portion. These contact gears, which are made with ordinary clip and blade contacts, or with "shorting" contacts, are adaptable to any type of lamp or fitting. A simple winch designed for operation in conjunction with the suspension gear consists merely of four cast pieces of metal. A double winch provides for both lowering and raising, and traversing, the same handle serving both operations.

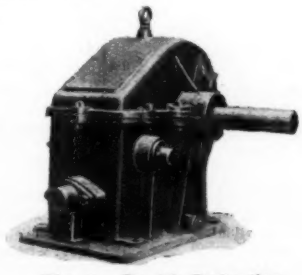


Fig. 3.—Double-Reduction Gear.

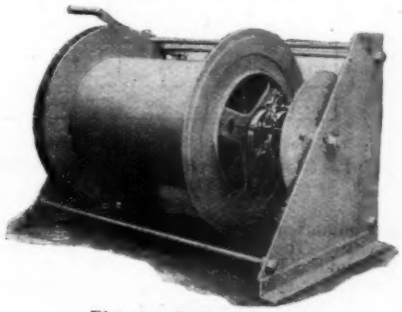


Fig. 4.—Cable-Carrying Drum.

Fig. 4 depicts a further result of the firm's activities. It is a cable-carrying drum intended for feeding motors driving such apparatus as mine-sinking pumps. The brush gear is totally enclosed and weatherproof. The slip rings are fixed with the incoming cables connected to them, while the brushes revolve with the drum.

Suitable connecting clamps are provided for different types of cable, which is taken from the barrel over a guide pulley. The drum accommodates about 250 yards of heavy cable; it is spur geared, and provision is made to prevent motion when necessary.

Such apparatus as flexible couplings are also features of the works products.

Fusing Tests.

A report of the British Electrical and Allied Industries Research Association on investigations into the current rating of low-pressure ordinary-duty fusible cut-outs.

By P. D. MORGAN, B.Sc.

(*Abstract of a Paper read before the* Institution of Electrical Engineers.)

THERE are at present two distinct methods of rating in use in Great Britain for ordinary-duty fusible cut-outs. The first method, adopted in B.S.S. No. 88, is that of specifying the ratio

minimum blowing current/rated carrying current,

so that the whole basis of rating depends on the definition and measurement of the minimum blowing current. This quantity is defined in the specification as the "smallest current which will blow the fuse." Theoretically this current would only blow the fuse link in an infinite time, a test condition which, obviously, can only be checked approximately in any case and, even then, is a laborious process, as it involves the taking of a time-current curve, so that from a practical standpoint the specification is unsatisfactory. The second method is that specified in the I.E.E. Regulations for copper wires, and bases the rated carrying current on the current required to blow the fuse in one minute. Owing to oxidisation, when a tinned-copper wire is tested "free in air," the time-current curve is discontinuous over a time range which, for the sizes of wire under consideration, may occur anywhere between about 20 seconds and 12 minutes, depending on the particular diameter of wire chosen. Over this uncertain part of the curve a wire may have two widely different times of operation for the same blowing current, which introduces so large an element of uncertainty that the method is of little practical value.

On the Continent and in the United States the method of rating is that of specifying that a cut-out *shall not blow* in a stated time on one given multiple of the rated carrying current, and *shall blow* in a stated time on a second given multiple of the rated carrying current. This method, with certain modifications, is put forward as a tentative basis for the rating of low-pressure ordinary-duty cut-outs up to 100 amperes rated carrying current. To avoid the period of discontinuity, the time basis must be either less than about 20 seconds or greater than about 12 minutes. The shorter period is unsuitable, as it would not give sufficient time for the cut-outs to reach a maximum temperature anywhere approaching that attained in practice. The test period must therefore be greater than 12 minutes, but not too long, otherwise it would be unsatisfactory for economic reasons. As a compromise, a test period of 30 minutes is proposed. The determination of suitable maximum and minimum test currents involves consideration of the sources of variation in 30-minute blowing current liable to be encountered in determining the size of fuse link for a given carrier, and the relation between the minimum test current and the rated carrying current, to guard against undue deterioration of the fuse link in service under the worst conditions. The results of a set of preliminary tests showed that to avoid excessive deterioration a tinned-copper wire should not be rated higher than 50 per cent. of its 30-minute blowing current. Thus, when a fuse link is carrying a rated carrying current which is the maximum allowed by the proposed specification, it must not be passing more than 50 per cent. of its 30-minute blowing current.

A typical example of curves connecting blowing current and time of operation for wires of various gauges is given in fig. 1, for No. 19 S.W.G. tinned-copper, 135 mm. long, and between 120-gramme brass terminals. It will be observed that test points connecting blowing current and time of operation do not lie on a smooth curve over the whole range between 4 seconds and 37 minutes, but that there is a discontinuity between about 30 seconds and 4 minutes, at a current value between about 69.3 and 70 amperes. Above 70 amperes the wire will *always blow in less than* 30 *seconds*, and below 69.3 amperes the wire will *always take at least 5 minutes to blow*. Moreover, between 69.3 and 70 amperes there are two definite "times of operation" for the wire for any current, one a short time less than 30 seconds and the other at least 4 minutes, but no times of operation were found between these two values. To show this period of discontinuity more clearly a portion of curve A has been drawn to a larger scale. This discontinuity occurred over the whole range of wires tested, and it is evident that the particular value of time of operation at which it starts, and also the duration of the period, depend on the size of the test wire.

To determine the reason for the discontinuity, records were taken of the potential drop across the ends of test wires at successive 5-second intervals after switching on, and some of the results are given in fig. 2. Curves A and B are for a No. 19 S.W.G. wire, the steady current being 69.3 amperes in both cases. In curve A, the potential difference rises continuously from the time of switching on and the wire fuses in 34 seconds. In curve B, however, the potential difference rises less slowly from about 10 seconds after switching on, reaching a maximum at about 26 seconds, then decreasing to a minimum at about 58 seconds, and thereafter steadily rising until fusion after 5 minutes 50 seconds. The shape of this curve is intimately connected with the phenomenon of discontinuity. It appears that if a wire lasts long enough, with a given current, to get over the peak of potential difference shown at S on curve B, fig. 2, it is unlikely that fusion will occur, at least until the potential difference again commences to increase with time, and this is the reason for the discontinuity. Over the range of current in which discontinuity occurs an apparently insignificant factor, such as a very slight puff of air at the critical moment, will determine whether curve A or curve B is to be followed.

Out of a total of seven cases, the blowing current "free in air" was reduced in four and increased in three instances. Where the blowing current was reduced, the amount of reduction was fairly constant and varied between 11 and 14 per cent., but where it was increased the increase varied from 3 to 24 per cent. The latter value, however, was for a 10-ampere cut-out in which the asbestos tube was very small in internal diameter and touched the fuse link very closely, so that this figure cannot be taken as representing average conditions, which, it is considered, would be met by providing for a maximum reduction of 15 per cent. due to insertion in the cut-out.

It has been shown that to decide on a suitable tolerance to allow above a minimum test current equal to twice the 30-minute blowing current, it is necessary to know the maximum percentage variation in the latter quantity due to:—

(1) Variation in the cross-sectional area of wires of the same nominal gauge.

(2) Slight differences in the manner of inserting the fuse link in the fuse carrier.

(3) The discrepancy in blowing current between that required for a particular rating and that obtainable from a schedule of blowing currents of wires of consecutive gauges.

Considering the first-mentioned cause of variation, test results show that the maximum variation in 30-minute blowing current due to this is ± 3 per cent., and the minimum

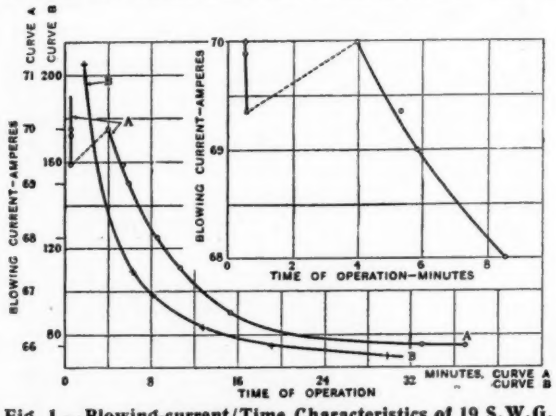


Fig. 1.—Blowing-current/Time Characteristics of 19 S.W.G. Tinned-copper Wire.

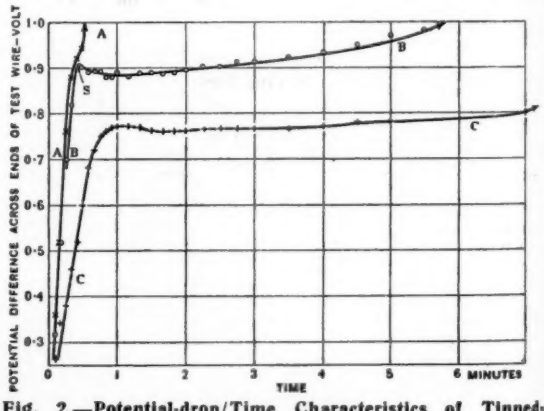


Fig. 2.—Potential-drop/Time Characteristics of Tinned-copper Wire.

variation ± 1.7 per cent. Due to cause (2), the greatest variation was about ± 2½ per cent. Some additional percentage, say, ± 1 per cent., making a total of ± 3½ per cent., would probably meet the case where care was not exercised to so great a degree. The variation due to cause (3) is roughly between 18.6 and 21.5 per cent., and as an approximation an error of 20 per cent. is allowed for. To take account of errors due to measuring instruments, an additional allowance of ± 0.5 per cent. has been made.

The total percentage variation in 30-minute blowing current due to all the above four reasons would be $6+7+20+1=34$ per cent. As, however, the simultaneous occurrence of all these errors in one direction is remote, it is considered sufficiently accurate to make an over-all allowance of 30 per cent. Consequently, the maximum test current will be 30 per cent. greater than the minimum value, *i.e.*, it will be 2.6 times the rated carrying current, but a designer should aim at securing an average value of 2.3 times the rated carrying current with a wire true to gauge. The proposed specification will therefore read as follows:—

"When tested in a vertical position in still air at an ambient temperature between 10 deg. C. and 25 deg. C., using commercial tinned-copper wire as a fuse link, the cut-out shall—

"Withstand 2.0 × rated carrying current for at least 30 minutes, and

"Blow on 2.6 × rated carrying current in less than 30 minutes."

The procedure given for calibrating a fuse carrier is thus resolved into the elimination of variations in rated blowing current due to variations in diameter of fuse link, and to the manner of insertion of the fuse link in the fuse carrier, and the confining of attention to the obtaining of a suitable single wire or combination of wires, the 30-minute blowing current of which shall be within ± 10 per cent. of a desired figure. If this is done, the designer is certain that, provided his instructions for wiring the carrier are followed by the user, the cut-out will comply with the limits allowed by the specification.

The evidence adduced tends to show that if commercial tinned-copper wire is used as a fuse link, the limit of accuracy on rated blowing current possible with existing designs of ordinary-duty cut-outs is about ± 15 per cent.

On the other hand, if specially constructed fuse links were used, then it is probable that the errors would be very greatly reduced, while if the fuse link were surrounded by a filler a further reduction due to the partial elimination of cause would result.

In other words, if close accuracy of rating is required, then a change is indicated both in the design of the fuse carrier and also in the construction and material of the fuse link.

Discussion in London.

Mr. W. WILSON commenced the discussion and welcomed the paper on the ground that in an article such as the small cut-out which was sold in very large quantities a small detailed improvement was of far-reaching importance. Referring to the author's indication that the enclosure of the wire in an asbestos tube reduced the blowing current, he pointed out that the "wiring regulations" showed an increase; but the results of tests carried out by himself seemed to confirm the author's suggestions. Among several of the author's definitions to which he objected was that of minimum blowing current; critical current would be much better, as this depended on the critical temperature. He objected to any suggestion that fuses were given routine tests—B.S.S. tests could be done in a couple of hours. Naked fuses, which were obsolete 20 years ago, did not give indications of the behaviour of closed fuses. He suggested that the "discontinuity" points shown by the author for tinned-copper in an asbestos tube were due to experimental error. Against his expectations he had found the time-lag for lead to be greater than for copper. Again, he had had it demonstrated that the time lag could not be increased by enclosing the fuse in a filler. He contended that the only definite point was that at which the critical current was obtained. Close accuracy was seldom called for from a fuse, which was not an overload device, and it did not matter very much what the overload was—it was very large in any case.

Mr. S. W. MELSOM thought that if the wire was well oxidised first the "discontinuity" might disappear. Slightly oxidising the wire affected the blowing current by 2 per cent. He thought that the author ought to have given more data in connection with his reference to Continental or American practice. There was great variety of opinion as to what was wanted in the rating of a fuse, and the suggestion in the paper was to extend the rating enormously; but it should be remembered that twice the rated current meant four times the heating effect on the apparatus and cables protected. He did not agree that copper would not run continuously without deterioration—he had run wire for about seven weeks without discolouration. A fuse must be expected to "go" once in a while; but that was no reason for increasing the rating. He suggested that the Research Association should seek a better material than copper; that metal was not necessary for large fuses, and there were other materials available for enclosed fuses.

Mr. A. M. POOLEY thought that the results of the author's tests proved that anything like close-limit rating was not possible with the present designs of fuse holders. The logical conclusion was either to use different metal for the links or change the design of the cut-outs. For close limits the cartridge fuse seemed desirable. Tests which had been carried out in the laboratory of the English Electric Co. agreed with those of the author.

Mr. Y. HOPE pointed out that in a patented fuse of his, blackening the metal had almost entirely eliminated the "discontinuity" trouble. If the ratings given in the paper were accepted, he thought that copper could only be used for protection against "short-circuits."

Mr. L. C. GRANT said that the two deciding issues should be accuracy and simplicity. Copper should be reserved for low-power work. Real protection could be got from cartridge fuses, of which there were some available which were guaranteed to within 20 per cent. operating limits. "Discontinuity," he thought, had not been entirely unrecognised in the past, and the question of oxidisation had also been touched upon.

Mr. S. WHITEHEAD noted that the experiments had been confined to tinned-copper; but pure tin had been said to be more accurate. He asked evidence of the author's contention that the rating should be 50 per cent. of the 30-min. blowing current.

Mr. OWEN suggested that the appropriate section of the I.E.E. regulations might be revised in the light of the new information which the investigations had brought out.

Mr. E. B. WEDMORE showed that there were three essential parts of the fuse characteristic: First, that at which there was practically no heat emission; then the long part where there was great loss of heat; and, finally, that part where the surroundings were heated up. Rating, he thought, should be based on the long period in order to take into consideration the third part of the characteristic. The use of 30 minutes allowed one to avoid the danger zone.

Mr. A. F. HARMER looked on the fuse merely as a protection against "short-circuit." The general tendency was to show that copper was unsuitable. No fuse should be smaller than 20 A.

In replying to the discussion, Mr. MORGAN said that he did not think that nomenclature mattered very much so long as there was uniformity. Tinned-copper had been used because it was considered that rupturing capacity was more important than close limits of accuracy. For up to 100-A ratings fuses were not called upon to look after the overload characteristics of apparatus, but only protection of the material. He agreed that the cartridge fuse could be made to give close limits of accuracy, and thought it might be worth while treating the metal. Referring to the query about the 50 per cent. rating, he pointed out that the statement in question was based on tests by Prof. Wilson in 1925. There were four considerations from which to choose: (1) by accepting deterioration; (2) by a radical change in the cut-out design; (3) by a small change in the design and using such a metal as tin; and (4) by changing the I.E.E. regulation.

Salt Spray and Transmission Lines.

Power station engineers in many parts of the country will remember the peculiar windstorm which occurred on the night of October 28th last, and the troubles which followed on overhead transmission lines. These were so pronounced on coastal systems, particularly in South Wales and the South West of England, that a number of leading engineers collaborated to find the cause. Dr. G. C. Simpson, F.R.S., a leading meteorological expert, was approached, and, in addition to rendering valuable assistance at the time, he consented to deliver a lecture on "Atmospheric Electricity," which was held under the auspices of the Institution of Electrical Engineers (Western Centre) at Cardiff on March 19th. Mr. C. G. Morley New presided over a record attendance of members, which included representatives of practically every undertaking in South Wales and the Western counties. Dr. Simpson outlined the theory of the formation of electricity in clouds and the effect of lightning discharges on transmission lines. During the discussion, Mr J. W. Burr (Swansea Corporation), Mr. S. W. Melsom (Callender's Cable Co.), Mr. H. Wilson (supt. engineer, Cardiff Post office), Mr. T. R. Kernick (South Wales E.P.D. Co.), Mr. H. Ellis (West Gloucester Power Co.), and Major E. Ivor David referred to the disturbances which had taken place during and after the storm, the direct cause of which had been proved to be the presence on the insulators of salt crystals blown inland by the strong wind. Various speakers referred to the methods they had adopted to overcome the trouble, such as washing the insulators, but it was generally agreed that the most satisfactory solution of the problem was to be found in greater insulation.

In reply to the discussion, Dr. Simpson said the gale was the most severe which had ever been recorded in this country. From a meteorological point of view, it was very exceptional in that it was an exceedingly dry wind. The humidity was something like 25 per cent., with the result that an exceptional kind of spray was put into the air; the salt partially dried out and was deposited in a sticky form. It was very unlikely that such a combination of conditions would recur. At the conclusion, Dr. Simpson was accorded a hearty vote of thanks, on the proposition of the chairman, seconded by Mr. C. T. Allan (hon. sec., Western Centre).

Electricity and the Chemical Industries.

A review of the requirements of the "Cheap-power Industries" and their bearing on the generation of hydro-electricity, with a consideration of the possibilities of development in this country.

By Sir ALEXANDER GIBB.

(*Abstract of the Presidential Address delivered before the* Institution of Chemical Engineers.)

With the development of cheap hydro-electric power there has been a phenomenal development of certain industries making use of such power in large quantities. The electrochemical load is the basis of the economical production of such electricity, and economically produced power is a *sine qua non* of the electrochemical industry.

The consumption of electricity in electrochemical processes naturally varies enormously, ranging from a few kWh per ton of one particular commodity produced to several kW-years for another. The following figures show the approximate consumption of electricity for the production of some selected materials: pulp and paper, 1,800 to 2,000 kWh per ton; hydrogen gas, 1,600 kWh per 1,000 cu. ft.; pig-iron, 2,000 to 3,000 kWh per ton; electrolytic zinc, 3,800 to 4,000 kWh per ton; calcium carbide, 4,000 to 4,500 kWh per ton; nitrogen (direct synthetic process), 5,000 kWh per ton; various ferro-alloys, 5,000 to 15,000 kWh per ton; phosphorus, 11,000 to 13,000 kWh per ton; magnesium, 18,000 to 20,000 kWh per ton; nitrogen (cyanamide process), 20,000 kWh per ton; aluminium, 25,000 kWh per ton; and nitrogen (arc process), 80,000 kWh per ton.

The world capacity of aluminium will soon be between 400,000 and 500,000 tons per year, involving the use of up to 2¼ million h.p. of electricity. At a cost of 0.1d. per unit at the factory, power is responsible for at least 20 per cent. of the total production cost of the metal, which to-day is about £63 per ton.

Changes have been taking place in the nitrogen fixation industry that indicate an important trend of chemical engineering. Of the three proved processes, the arc process now obtains almost solely in Norway. The efficiency of this method is extraordinarily low, 90 per cent. of the electrical energy being represented by the heat of the furnace gases, some of which, of course, can be turned to account. At .1d. per unit the amount of electricity required is so great that it would be quite impossible to compete with the other processes; the economic price for the process would appear to be certainly below .075d. per unit. The cyanamide process requires approximately one-quarter the electrical energy of the arc process, but is still definitely a "cheap-power" method dependent almost wholly on water power. The direct synthetic process requires something like a sixteenth of that used in the arc process, and for this reason, and owing to the fact that auxiliary use can be made of the exhaust steam, the synthetic process is entirely independent of water power.

The whole use of electricity in the manufacture of iron and steel is too complex a subject for even cursory consideration. It will be sufficient to state that pig-iron is now produced electrothermally from iron ore, and (the so-called synthetic iron) from scrap. With both the cost of power bears particularly heavily, in view of the low selling price of the product. At .1d. per unit the cost would be in the region of 22s. 0d., or over 30 per cent. of the present-day price. The electrical smelting of iron-ore is therefore confined to those countries where deposits of ore are contiguous to very cheap water power and where fuel is unduly expensive—that is to say, Sweden, Norway, and Italy. Synthetic iron, also a water-power product, is practically restricted to France and Canada. It has certain definite advantages of purity and flexibility which in certain conditions justify the cost of the power where this is low. Electric furnaces for refining steel are now, of course, an essential part of all modern steel works, and electrolytic iron and steel, too, have valuable qualities that foreshadow possible developments in this direction, but their comparatively low consumption of power and independence of a high process factor exclude these processes from the category of cheap-power industries.

Phosphorus is produced electrothermally, the principal raw material being calcium phosphate, the present cost of which is about £2 per ton. At .1d. per unit the electricity consumed would represent approximately 20 per cent. of the total cost, but the actual cost of the principal raw material to the manufacturers cannot be definitely ascertained, and is a variable quantity.

Much of the calcium carbide produced is used for the fixation of nitrogen by the cyanamide process. The raw materials are simply coke (or anthracite) and limestone, and their total cost is about £3 per ton of calcium carbide produced. The cost of energy at about 35s. 0d. is therefore the heaviest item in the process.

The above figures should give some idea as to what is really implied by the phrase "Cheap power industries." The cost of power has, in fact, been the predominating, sometimes almost the sole, consideration in the location of these industries. Their grouping at Niagara was originally due to the supply of what was then the cheapest power in America. Niagara now offers every facility to the manufacturer except really cheap power, and isolated and almost inaccessible Canadian sites are in consequence being exploited in preference by those who can afford to do so. Similarly, Norway and Switzerland have always been obvious fields for certain branches of electrochemistry. But the point of prime interest is, what really constitutes cheap power from the point of view of the location of electrochemical and electrometallurgical industries?

In taking a 100 per cent. load-factor, no considerable margin of error is involved. The cheapest electricity in the world is, or certainly was, to be had from some of the pre-war Norwegian hydro-electric installations. Their total capital cost was in one or two instances at the amazing figure of approximately £4 10s. 0d. to £5 0s. 0d. per h.p., and the average for Norwegian developments before the war was not very much above £10 per h.p. In other countries the capital cost was as low as £12, and there was available power at from about .04d. to .08d. or .09d. per unit. It is almost certain that we shall never again see water-power developments on such a cheap scale, although it may be possible in, say, Norway or Canada, to see a large hydro-electric undertaking established at a capital cost as low as £20. The estimated cost of the development of the Slave River project on the Winnipeg River, which is now under construction, is only £21.6 per h.p., but any water-power station which can be developed for anything under £25 per h.p. must be considered as unusually cheap.

It may be assumed that the average cost at the switchboard of hydro-electric power in the most favourable conditions in a large-scale development, on a 100 per cent. load factor, will now lie somewhere between .065d. and .125d. per unit. The Aluminium Company's huge development now in hand at Chute a Caron, on the Saguenay River in Quebec Province, and the Duke-Price hydro-electric installation at Isle of Maligne on the same river, are generally believed to be as cheap as any large-scale post-war hydro-electric installation, and from the most favourable of various figures quoted, the production cost seems to be not less than .065 of a penny per unit at 100 per cent. load factor. In a typical, but smaller, Norwegian development the Norwegian Government leased power for a large-scale electrochemical works at .075d. per unit delivered.

Generally, then, we may take .07d. to .145d. as the outside limits of the cost of power delivered to a nearby factory under favourable conditions in typical cheap-power countries.

In this country the only outstanding hydro-electric installation is the combined Kinlochleven and Lochaber developments of the British Aluminium Company, the final stage of which is not yet completed. They will together eventually produce 140,000 h.p. continuously available in all but very dry summers, at a total cost of a little under £40 per h.p., taking pre-war and post-war costs together. I have devoted much time to exploring the possibilities that hydro-electric development offers in this country, and I am satisfied that our water-power resources will eventually be found to exceed the estimates of the Water Power Resources Committee. But it will, I think, be exceedingly difficult to find sites of any importance capable of development at £40 per h.p. The average will be considerably higher, and in many cases transmission costs will be an inevitable extra. We should be over-sanguine to hope for any hydro-electric power plant in this country capable of producing at .125d. per kWh, and I am inclined to think that, with a few exceptions, we are not likely to be able to get water power in present circumstances at much less than .16d. per unit. No doubt improvements in detail will result in existing wastage and losses being further reduced, but it has to be remembered that hydro-electric development started at a high rate of efficiency, and the percentage of the actual h.p. now obtained to the theoretical h.p. is such that large improvements are practically out of the question. There is, of course, tidal power, but the many necessary technical improvements for efficiency will only be possible when someone has the courage to try them out. Economically the position is less clear. I am convinced that sooner or later we shall utilise the tides, but the solution will be in conjunction with steam power stations and "the Grid."

It appears to be inevitable that hydro-electricity in this country will generally cost considerably more than in the most favoured water-power countries, but if we must reconcile

ourselves to being not amongst the most favourably situated hydro-electric countries, we can equally comfort ourselves, in view of our coal resources, both as regards quality and quantity, that the margin between steam power and water power the world over, and all the more in Great Britain, is much less now than it was. With a 50 per cent. load factor, electricity is now being generated on a large scale at a switchboard cost of about .275d. per kWh, and I am confident that a modern 100,000-kW steam power station in the most favourable circumstances could in these days be built to produce electricity on the basis of a 100 per cent. load factor at .185d. per unit at the switchboard. In a year or two the figure will be .175d. Further, the efficiency of the generation of electricity by steam is still comparatively low, and there is a corresponding opportunity for improvement. A modern steam power station, then, is already able to compete, on a 100 per cent. load factor basis, with a hydro-electric installation costing anything more than £65 per kW of capacity. As the load-factor falls so the advantage of the steam power station becomes greater. At about 50 per cent. only really cheap water power can compete. Up to the present the best steam results are not so favourable as hydro-electric figures, but whereas—speaking generally—the most economical water-power sites have already been developed, and whereas the efficiency of water-power plant has already reached nearly to its possible limit, the trend of development in steam stations is more promising, and they will in many cases in the future be able to compete with new water-power development.

It appears then that this country falls short of the requirements of the cheap power industries. But, fortunately, there are other considerations. The more one considers the history of these cheap power industries, the more evident it becomes that cheap power has been allowed to play a somewhat disproportionate part in their development. It is a fact that in some of the most important electrochemical industries the processes are now almost exactly the same as they were thirty years ago, and entail an uneconomic use of electricity. The profusion of cheap electricity has, indeed, to some extent been a disadvantage in that it has tended to remove the incentive to research and invention which otherwise economic factors would have forced. Here in this country we can hardly hope ever to have ultra-cheap hydro-electric power, but that should really be an encouragement to us.

Electricity Supply in Great Britain.

Fuel Consumption Returns for 1926-27.

THE summarised returns made to the Electricity Commissioners of the units generated and fuel consumed at the generating stations in Great Britain during the year ended March 31st, 1927, have now been published (H.M. Stationery Office, price 1s. 6d. net), and, as was the case last year, they contain a complete alphabetical list of all the stations from which returns were received, in most cases giving a summary of the technical results of the working. Returns were received in respect of 570 undertakings, a decrease of 14 as compared with the previous year, consequent upon the closing down of 26 stations and the coming into operation of 12 new ones.

Again the Barton station of the Manchester Corporation heads the list for the lowest fuel consumption, the figure being 1.33 lb., as compared with 1.36 lb. for the previous year. The units generated amounted to 300,771,400, the thermal efficiency of the station was 21.83 per cent., the maximum load, 64,500 kW, and the station load factor 53.2 per cent.

The next best station is shown to be Grove Road, of the London Power Co., Ltd., which consumed an average of 1.71 lb. of fuel per kWh, against 1.81 lb. for the previous year. The units generated amounted to 133,388,110, the thermal efficiency was 17.90 per cent., maximum load 62,900 kW, and the load factor 24.2 per cent.

The Radcliffe station of the Lancashire Electric Power Co. consumed 1.76 lb., with a thermal efficiency of 17.14 per cent., and the Bradford Corporation station (Valley Road) followed closely with a consumption figure of 1.77 lb.

The North Tees power station of the Newcastle-upon-Tyne Electric Supply Co., Ltd., which was second on the list last year with a fuel consumption of 1.51 lb., this year is shown as having consumed 1.86 lb. per unit.

Other stations with consumption figures under 2.0 are: Agecroft (Salford Corporation), 1.81; Dalmarnock (Glasgow Corporation), 1.82; Mersey Power Co., 1.89; Clyde's Mill (Clyde Valley Electrical Power Co.), 1.90; Barking (County of London Electric Supply Co.), 1.91; Carville (Newcastle-upon-Tyne Electric Supply Co., Ltd.), 1.93; Plymouth Corporation, 1.94; South Wales Electrical Power Distribution Co. (Upper Boat), 1.94; Wimbledon (Southern Railway), 1.95; Bow (Charing Cross Electricity Supply Co., Ltd.), 1.97; and Maidstone, 1.99. With the exception of the destructor station of the Rhondda Urban District Council, which had a load factor of 64.5 per cent., the Barton and Norwich (Tramway) stations had the highest load factor, 53.2 per cent., followed closely by the Cornwall Electric Power Co.'s station with a load factor of 52.2 per cent. The thermal efficiencies for Norwich and Cornwall were 8.83 per cent. and 11.48 per cent., respectively.

Group A (over 200 million units per annum) accounted for seven stations, with an average fuel consumption of 2.06 lb. These stations generated a total of 1,653,870,334 units. In the B group (100-200 million kWh), 11 stations generated 1,579,361,162 kWh for an average fuel consumption of 2.08 lb. The corresponding figures for the Groups C (50-100 million kWh) and D (25-50 million kWh) are 1,792,092,583 (26 stations), and 2.27, and 1,583,167,698 (46 stations) and 2.53 respectively. In the last Group M (under 50,000 units) 12 stations (steam) generated 233,232 units for an average fuel consumption of 14.34 lb.

Of the oil-driven stations the lowest consumption figure was 0.62 lb. for the station of the Alderley and Wilmslow Electric Supply, Ltd., which shows a thermal efficiency of 27.91 per cent., total units generated 671,094, and a load factor of 17.2 per cent. The total number of units generated by 111 oil-driven stations was about 65½ millions, the average consumption being 1.10 lb. per kWh. The previous year's return showed a total generation of 45½ million units by 101 oil stations, with an average consumption of 1.05 lb. per kWh.

The lowest fuel consumption recorded for the gas-producer stations is 1.73 lb. of coal per kWh for the Guernsey Electric Light & Power Co., Ltd., against 1.61 lb. for the preceding year. This station generated a total of 3,206,255 units at a thermal efficiency of 16.0 per cent. and a load factor of 23.2 per cent. About 20 million units were generated by 56 gas-producer stations with an average consumption of 2.47 lb. per kWh; 25 stations using town's gas generated three million units, and 17 waste-heat stations generated 78 million units.

The highest number of units generated for any one area was 2,354¼ millions for No. 7 area (London and Home Counties), which had 82 stations.

Legal.

Alleged Theft of Radio Goods.

AT Old Street, on March 28th, Thomas Wybrow, motor driver, Hackney Road, Robert Smith, painter, Finsbury, Joseph Broderick, labourer, Hoxton, and James F. Murray, painter's labourer, Finsbury, were charged with being concerned together in stealing and receiving 24 valves, 24 switches, and a quantity of other radio apparatus, valued at £29, the property of the Peto-Scott Co., Ltd. They pleaded guilty.

Detective-Sergt. CORY said that Wybrow was employed as a carman to move stores from Bunhill Row to Hoxton, and the other three prisoners had been employed temporarily as warehousemen. Apparently Wybrow collected a sack of the goods and concealed it under his driver's seat with the collusion of the other three prisoners. They met later and each of the men received 15s. Wybrow and Murray were remanded, and Smith and Broderick were bound over and placed on probation.

Claim for Defective Batteries.

IN the Mayor's and City of London Court, before Mr. Registrar Dell, the hearing was resumed of a claim made by Mr. H. Wiseman, Houndsditch, against Mr. J. Roysental, Camomile Street, E.C., wireless dealer, for £3 18s. 4d. for defective batteries supplied. Plaintiff said he gave an order to the defendant for 1,000 batteries which were delivered in November and December last. After receiving many complaints from his customers about the batteries he returned the remainder to the defendant, in January last, as faulty. Plaintiff contended that it was usual for faulty batteries to be exchanged at any time within three months, and with this the defendant agreed. The defendant admitted that the batteries had been returned, and that 71 of them, after testing, were bad, but contended that the others were in good order. The Registrar had ordered the plaintiff to attend with the defendant at the latter's premises, identify the batteries, and have them sent to the Court. The plaintiff now stated that he had been unable to get any satisfaction from the defendant, who did not now appear.

The REGISTRAR said he had given the defendant a chance to have the batteries tested in Court, but he failed to take advantage of the opportunity offered him. He had admitted that some of the batteries were bad, and he (the Registrar) was satisfied about the plaintiff's claim. There would be judgment for the plaintiff for the amount claimed, and an allowance for the plaintiff's attendance at Court.

British Thomson-Houston Co., Ltd., v. Davey.

MR. JUSTICE RUSSELL, in the Chancery Division, on March 27th, granted an injunction to the British Thomson-Houston Co., Ltd., restraining W. Davey, Leeds, from infringing its letters patent for gasfilled incandescent electric lamps and leading-in wires, and ordering him to deliver up all infringing lamps in his possession, together with an inquiry as to damages and costs. There was no defence.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this Section.

A Meter-Terminal Protecting Box.

A simple but, it is claimed, effective method of preventing tampering by unauthorised persons with the terminals of electricity supply meters has been invented and patented by Mr. DAVID E. REES, 1, The Terrace, Old Ford Road, Bethnal Green. E.2. The invention incorporates a chamber at the meter terminal block through which the leads have to pass, and the idea is to prevent a straight passage for the wires from the entrance holes in the chamber to the meter terminals by means of an obstacle in the form of a bar fixed half-way up the chamber. The chamber may take the form of a separate box, fig. 1, which is shortly to be manufactured

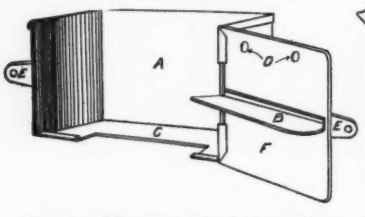


Fig. 1.—Meter-terminal Protecting Box.

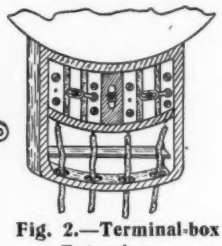


Fig. 2.—Terminal-box Extension.

by Messrs. Howard Wall, Ltd., 25, Hackney Road, E.2, or the terminal block of the meter may be extended as in fig. 2. Referring to fig. 1, the bulk of the box is the front A, which closes on the back F, holding the obstacle bar B. The back is slipped under the lead-in wires and screwed to the meter board at the holes D. When the box is closed C forms the outlet for the wires. The lugs E provide the means of sealing the box either to the meter or independently. The arrangement in fig. 2 is self-explanatory.

A further patent taken out by Mr. Rees is for a protection plate for meters, fuse boxes, and so on, which is fitted between the terminal to be protected and the case. This embodies the same out-of-line principle as that for the protecting box.

A Portable Dehydrating Outfit.

What should prove useful in connection with the drying out and refilling of oil-filled transformers and similar apparatus after installation or repair is the "Auto-Isobar" dehydrating apparatus, fig. 3, a production of the SOCIETE ANONYME

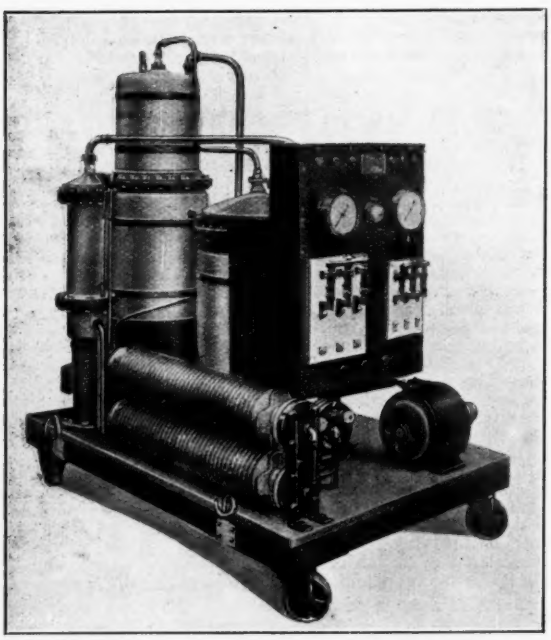


Fig. 3.—"Auto-Isobar" Dehydrating Set.

M.A.X.E.I., whose address in this country is 66, Victoria Street, S.W.1. It is claimed that the apparatus will ensure, simultaneously, the complete drying out of the oil tank, core and windings, and the perfect dehydration of the oil in a vacuum at a temperature of below 100 C., thereby eliminating risk of oxidisation or fire. With the outfit it has been found possible to completely "oil up" a 10,000-kVA transformer in 48 hours, leaving the oil with a dielectric strength of 85,000 V after the completion of the work. The outfit is designed so as to be suitable for transportation by either road or rail. All that is required when being put into service is the necessary connection by flexible tubing to the transformer. The apparatus is made in six sizes with outputs in gal. per hour varying from 110 to 660, power requirements for heating from 36 to 200 kW, and driving motors of 3 to 3½ h.p.

Two Special Lamps.

Two recently introduced novelties of MESSRS. PHILIPS LAMPS, LTD., Philips House, 145, Charing Cross Road, W.C.2, are the "Duo-Photo" and "Duo-Savelite" lamps. The former is intended to provide photographers with alternative illuminations in the dark room from one source. It is equipped with two filaments in one opal glass bulb, one filament being shielded by a ruby-glass bulb. Either filament is actuated by means of cords controlling a switch in the cap. The consumption for either filament is 40 W. According to the *Illuminating Engineer* the company is engaged in perfecting a lamp of similar design, but for giving white or yellow light for gaslight or bromide papers.

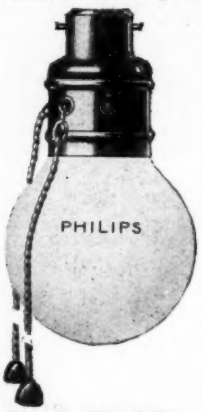


Fig. 4.—The "Duo-Savelite" Lamp.

The "Duo-Savelite" lamp, fig. 4, embodies the same principle, having two filaments controlled by a switch in the cap. In this case both filaments are "open" and the respective consumptions are 25 and 4 W. The low-power filament can be used as a night-light or in such places as the hall of an ordinary house, where a very small light is all that is necessary at times. The bulb of this lamp is also of opal glass.

New Induction Motors.

MESSRS. NEWTONS OF TAUNTON, 224, Shaftesbury Avenue, W.C.2, have drawn our attention to the range of polyphase induction motors which they have recently placed upon the market. These machines can be supplied in all the standard B.E.S.A. patterns, for both the squirrel-cage and slip-ring types, and are at present made up to 50 b.h.p. The S.C. motors are wound either for across-the-line starting for the smaller sizes, or star-delta, series-parallel, or auto-transformer starting in the case of the larger machines. When switched straight on, the full-load starting torque developed is from four to six times the full-load current. With star-delta starting 33 per cent. full-load torque is developed for from 1½ to 2 times the full-load starting current. For auto-transformer starting from 25 to 60 per cent. full-load torque is developed for from 1 to 3½ times the full-load current. The slip-ring motors can be designed for starting against up to twice full-load torque, the current for which is approximately 1¼ times the full-load current. Roller and ball bearings are fitted at the driving and other ends of the machine, respectively. The ventilating fan blades are cast integral with the end ring, so avoiding any trouble from loose fans.

A Battery-condition Indicator.

A device which is intended to show the charge condition of accumulators used for lighting and starting purposes on motor vehicles has lately been put on the market by MESSRS. TYER & CO., LTD., Ashwin Street, Dalston, E.8. It is designed for fitting to the dashboard of a motor vehicle, and comprises a moving-coil meter with a scale having three coloured divisions. The needle pointing to the division on the extreme left, red, indicates that the battery is discharged. The central section, yellow, corresponds to a medium state of charge, whilst the fully-charged division, blue, is on the right and has an indicating mark in red which, when reached by the pointer, is an indication that the supply must be switched off. The yellow portion of the scale is calibrated in ampere-hours. The instrument is connected directly across the terminals of the battery. To ascertain the battery condition after ensuring that the dynamo is not charging, a load is put on the battery by momentarily switching on all the lights. Should the pointer not remain stationary, but gradually move to the low end of the scale, it is an indication that the battery is either not in good condition, or that the acid in the battery is not of the correct density. The instrument, the current consumption of which is only 6 milli-amperes, is supplied in black or nickel-plated finish. A model with a moving-iron meter and not calibrated in ampere-hours, is also available.

Parliamentary News.

[By Our Special Parliamentary Reporter.]

Wireless on Aeroplanes.

On March 26th, Mr. DAY asked the Secretary for Air whether he would consider the introduction of legislation making it compulsory for all aeroplanes leaving Great Britain for any distance exceeding 1,000 miles to be equipped with wireless equipment and life-saving apparatus.

Sir S. HOARE replied that while in the case of aircraft carrying passengers for hire a reasonable degree of control was clearly required, the policy hitherto pursued as regarded other aircraft had been to leave the activities of pilots unrestricted except in so far as might be necessary in the interests of persons and property in the vicinity flown over. He considered that it would be undesirable to exercise a more far-reaching and elaborate control over such aircraft.

Failure of Public Electricity Supplies.

On March 27th, Mr. LEE asked the Minister of Transport whether he had had any complaints as to the failure of public electricity supplies during the past six months and to the danger of interrupted service in hospitals and similar institutions, and whether alternative supplies were being established or recommended for establishment by his department.

Colonel ASHLEY said that the Electricity Commissioners had received a certain number of complaints as to the failure of public electricity supplies, but no specific representation as to the danger of interrupted service in hospitals and similar institutions. One of the objects of the schemes of interconnection to be carried out under the Act of 1926 was to ensure increased reliability of supply by providing alternative sources of supply for authorised undertakers.

The Control of Communication Companies.

On March 29th, Mr. W. BAKER asked the Prime Minister what guarantees existed to prevent the transfer of privately-owned cable and wireless companies, which formed integral parts of the system of imperial communications here and in the Dominions and elsewhere, to foreign ownership or control; and whether he was satisfied that the terms of the existing licences and agreements were sufficient to safeguard the national interest.

Mr. BALDWIN said he could not answer as regarded the position of the other Governments concerned, but all licences for cable or wireless services granted by the British Government contained a provision that the licensed company should not assign or dispose of the licence or of any benefit arising from it without the consent of the Government. The question whether any further safeguards were necessary would be considered when the report of the Imperial Wireless and Cable Conference had been received.

The Loop Direction-finding System.

On March 27th, Sir R. THOMAS asked the President of the Board of Trade whether his department had yet instituted any experiments into the wireless loop direction-finding system.

Sir P. CUNLIFFE-LISTER said that the rotating loop direction-finding system had been developed by the Air Ministry as an aid to air navigation. The system had been investigated by the Department of Scientific and Industrial Research, and preliminary trials had been carried out in connection with marine navigation. The Board of Trade had considered the results of that investigation and were now examining, in conjunction with the Air Ministry and the Trinity House, the question of establishing an experimental station of that type in a position where its utility, as an aid to shipping, could be fully explored. It was hoped to reach a decision on that question very shortly.

The Telegraph Service.

On March 27th, Sir H. BRITTAIN asked the Postmaster-General whether his department had made a close study of the working of the telegraph service in countries where that system was carried out under private enterprise with satisfactory financial results, and whether he would consider introducing certain of those business methods into this country.

Sir W. MITCHELL-THOMSON said his hon. friend presumably referred to the United States of America. He hoped to arrange shortly for another visit to be made by officers of the Post Office with a view to a close study of the American telegraph service, but it could not be assumed that all the methods in force in the United States would be found suitable for adoption in this country.

On March 27th, Mr. WELLS asked the Postmaster-General if he proposed to take immediate action to carry out any of the recommendations of the Committee on the Inland Telegraph Service.

Sir W. MITCHELL-THOMSON said that some of the proposals recommended by the Committee were in fact being carried out before the report was received, and arrangements were now in progress for giving effect to others. The remaining proposals affected various interests both external and internal, and a good deal of time would be required for their consideration both by the Government and by the interests affected.

Cable Messages to India.

On March 27th, Mr. PILCHER asked the Postmaster-General if he would state whether, and, if so, what, reductions in cost of cable messages to India and South Africa had been conceded since the introduction of beam competition during the past year, and whether he could give an assurance that such reductions would not be annulled as a result of a cable-wireless merger or through other causes.

Sir W. MITCHELL-THOMSON said that a year ago the cable rates to India and South Africa were 1s. 8d. a word and 2s. a word respectively. The present rates to India were 1s. 5d. by cable and 1s. 1d. by beam; and the rates to South Africa were 1s. 8d. by cable and 1s. 4d. by beam. Corresponding reductions had been made in the rates for deferred telegrams and letter telegrams. No statement could be made concerning future rates until the report of the Imperial Wireless and Cable Conference had been received and considered.

Beam Wireless.

On March 27th, Sir H. COWAN asked the Postmaster-General whether his attention had been called to the possibility of tapping beam wireless messages to and from Australia; and what steps he proposed to take to ensure the privacy of such messages.

Sir W. MITCHELL-THOMSON said he was aware that the Anglo-Australian beam service, in common with other wireless services, had been criticised on the ground that it was liable to illicit interception. In practice, however, the beam services were worked at so high a speed that interception would only be possible by means of complicated and expensive receiving apparatus requiring expert operating staff. Therefore the risk of illegal interception was negligible.

Broadcasting Matters.

On March 27th, Mr. W. BAKER asked the Postmaster-General whether he had any official information as to the success of the experiments in Germany in effecting the elimination of interference with broadcast reception caused by friction-bow trolleys as compared with the roller-trolley system; and whether he would state what tramway authorities were co-operating with his technical officers in the endeavour to eliminate that technical difficulty.

Sir W. MITCHELL-THOMSON said he understood that no effective remedy had yet been found either in this country or in Germany for interference with broadcasting caused by trams working on the roller-trolley system. Tramway authorities in various parts of the country, notably at Birmingham, Blackpool and Glasgow, were experimenting with various devices, but the experiments were not yet completed. The engineers of the British Broadcasting Corporation and of the Post Office were co-operating with the tramway authorities in an endeavour to find a remedy.

On March 27th, Sir W. MITCHELL-THOMSON informed Mr. Everard that the British Broadcasting Corporation was authorised last September to undertake experiments in broadcasting on a short wave length. Those experiments were still in progress, and the results had not yet been reported.

On March 27th, Captain GARRO-JONES asked whether steps were being taken towards establishing a broadcasting service receivable on sets of moderate cost in such places as West Africa and East and Central African Colonies, where thousands of British citizens were in remote and lonely stations.

Mr. PENNY said that the difficulty in providing such a service lay not in the transmission but in the reception. The British Broadcasting Corporation had been conducting almost daily transmissions from its short-wave station 5 S.W. ever since December 12th last, and those programmes had been heard from time to time throughout Africa and elsewhere. He understood from the Corporation, however, that prolonged experiments under varying conditions were likely to be required before suitable receiving machinery could be evolved. The Government could obviously give little help in that matter, but the Colonial Governments were co-operating by forwarding reports on local reception.

Funds of Electrical Undertakings.

On March 27th, Mr. WELLOCK asked the Minister of Transport if, in view of the statutory limitations placed on dividends of electrical undertakings, he could supply figures showing what transfers, if any, of funds from reserves to capital account in the form of bonus shares had taken place in those electricity undertakings whose area of distribution had been enlarged as a result of the decisions of the Electricity Commissioners.

Colonel W. ASHLEY said he was not aware that any electricity undertaking had transferred funds from reserves to capital account in the form of bonus shares as the result of its area of distribution having been enlarged.

London Electricity Charges.

On March 27th, Mr. DAY asked the Minister of Transport whether he had received applications from any of the municipal authorities in the County of London asking him to set up an inquiry into the prices charged by the County of London Electric Supply Company, and what decision he had arrived at.

Colonel ASHLEY said he had received no such application, but he understood that one was likely to be received shortly.

Correspondence.

Correspondents should forward their communications **as early as possible.** *No letter can be published unless we have the writer's name and address in our possession.*

Impregnation of Insulation.

I have read with interest the recent correspondence on this subject, and have been disappointed to note that it has been conducted in the main by correspondents interested more particularly in the manufacture of the plant rather than in its use.

It is difficult to avoid being impressed with the fact that the authors of recent books on insulation, as well as of articles in your journal, have unanimously agreed that excellent results are obtained by introducing oil varnish into coils by a dipping process after preliminary heating and drying in a suitable oven.

Some writers go so far as to maintain that vacuum impregnation is cumbrous and unnecessary, to say nothing of the initial expenditure, and their view is supported by the representatives of varnish manufacturers, who on more than one occasion have confidently stated that equal results are obtained by the dipping process; moreover, it is common knowledge that a number of well known firms adopt this simple and straightforward method, although there can be no question but that they could afford vacuum impregnating plants if that method were conclusively proved to be the best. It will, of course, be understood that I am not at present referring to "Bakelite" varnish.

On theoretical grounds it is probably easy to prove that a combined vacuum-pressure system of varnish impregnation is the best, but there are several points which your correspondents have not dealt with fully, but which are of primary importance; for example, one of your correspondents indicates that the pump should be capable of producing and maintaining a vacuum of about 30 inches, but on referring to makers' catalogues I find that none indicate that their pumps or plant are capable of such results or that this high vacuum is necessary.

Another of your correspondents insists upon the importance of pressure, and on theoretical grounds I believe most engineers would agree, but only a user fully appreciates the inconvenience and annoyance which result when the application of such air pressures introduces moisture into his vacuum chamber. Every engineer who has had experience with compressed air realises that moisture will always be produced by condensation in the air receiver, and this takes place when compressed air is used in an impregnator, yet, how many manufacturers of impregnating plant have realised this point and provided means for drying the compressed air before applying it to the surface of the varnish in the impregnating chamber?

I am in a position to state that more than one manufacturer has found that in the absence of special air-drying systems it is best to eliminate the compressed-air process, as the moisture introduced into the chamber and varnish more than off-sets the better penetration of the varnish into the coils. It is a common fallacy to imagine that a coil impregnated with varnish, but still "wet," is in a state to resist the entrance of moisture.

Another of your correspondents outlines a system whereby the evaporation and the oxidisation of the varnish are in two separate operations, and for this purpose a centrifugal air blower is introduced in the pipe line, so that warm air may be circulated over the articles impregnated. Here again the idea is excellent in theory, but I can assure your readers that it will only be successful in practice provided that the condenser for the extraction and/or recovery of the solvent is of very large dimensions and of the highest efficiency, whereas in general the condenser supplied with impregnating plants is calculated to deal with the volume of air and solvent vapour at a rate based on the speed and capacity of the vacuum pump, which is, of course, only a small fraction of the rate at which the air and solvent vapour will be passed through the condenser when impelled by the centrifugal air blower necessary to carry out this dual process of evaporation and oxidisation of the varnish. In the absence of a condenser of suitable design and dimensions to quickly remove the solvent vapour circulated at a high rate by the centrifugal blower, the coils undergoing impregnation will not only take much longer to dry as compared with oven drying, but they will be so thoroughly washed with the solvent in vapour form that practically all the varnish will be removed from the outer layers. Incidentally, recent experience seems to show that a varnish of relatively high gravity is preferable, although the consistency of the material would be uncomfortably thick for dipping or brushing work.

A further point which I would wish to see discussed is concerned with correct methods for measuring the temperature in the vacuum chamber. It has been noted that with high vacuum it is difficult to measure temperatures accurately, as in such a case the transfer of heat in the chamber is mainly by radiation, and therefore the kind of thermometer may be of importance.

It is customary to impregnate at temperatures ranging from 90 deg. to 100 deg. C., or in other words, close to the limits of temperature to which cotton and silk insulation may be carried with safety, and it is therefore clear that a 10-20 deg. error in temperature may give rise to unfortunate results.

It will be generally admitted that the subject of varnish insulation is of great interest and importance to the electrical industry, and as there must be many of your readers in possession of a fund of useful practical information on this subject, it is to be hoped that they may yet be encouraged to take part in this discussion.

L. F. Fogarty, M.I.E.E.

Ruislip, *March 26th*, 1928.

Tapping the Single-phase Meter.

It has always been a source of amazement to me that the centre-tapped series coil of the a.c. single-phase meter has never been used to better advantage. Now that the Electricity Commissioners are getting into their stride, I think it is opportune to put forward what I think is lacking in electricity supplies. Take the small consumer with a few lights. On numbers of occasions the question is asked: "Does it pay to run, say, an electric iron or a vacuum cleaner off the lighting or heating circuit"? Then comes the discussion as to its merits and the invariable answer: "We will think it over," with the possibility of a lost customer. With the appropriate tapping of the series coil you can have a certain ratio; if necessary, you could have two or three tappings. One might suppose there were manufacturing difficulties; I don't think these are insurmountable, as usually not half of one per cent. of the shunt terminals is used. That does away with the connection board. The only extra cost would be involved in making a new series coil, and that could be considerably offset and could be saved by the meter board, the unnecessary wiring, and fixing, and last, but not least, considerable neatness in the average household. Now take the case of the accounts: instead of having two accounts to deal with, there is only one, one meter reading, an all-round saving in the commercial department, in the test room fewer meters to worry about, a less number of meters to stock, and a considerable saving in capital expenditure with regard to meters. In the case of a residential quarter where the load is more or less dependent on lighting and heating, it seems to me a case for investigation.

John G. H. Bowie.

Scarborough, *March 26th*, 1928.

A Crompton Jubilee.

On Friday last week the directors of Messrs. Crompton Parkinson, Ltd., gave a complimentary dinner to Col. R. E. Crompton, C.B., R.E., to celebrate the jubilee of the foundation of the firm of Crompton & Co., Ltd., at the Savoy Hotel, London. Mr. A. A. Campbell Swinton, F.R.S., M.Inst.C.E. (chairman of the company), presided, and about 180 covers were laid, the guests including Dr. S. Z. de Ferranti, F.R.S., Sir George Sutton, Bart., Sir Harry Haward, Mr. Archibald Page, Sir Tom Callendar, Mr. George Balfour, M.P., Lt.-Col. R. K. Morcom, C.B.E., Mr. Ll. B. Atkinson, and other leading representatives of the electrical and allied industries. An admirable souvenir of the occasion in the form of an interesting account of the history of Col. Crompton's firm, with many excellent illustrations, was presented to each guest.

Proposing the toast of the evening—"Colonel Crompton, C.B., R.E."—the Chairman commented on the Crompton motto, "Love and Loyalty," and remarked that Col. Crompton exhibited electrical machines at the Paris Exhibition of 1881, and at the Crystal Palace Exhibition of 1883, winning medals in both cases. He believed the firm was the first to manufacture searchlights in this country; it also supplied the first plant for electrical pumping at a dry dock, and had recently made similar machinery for the two largest floating docks in the world.

Dr. S. Z. de Ferranti supported the toast, reviewing the marvellous progress that electrical engineering had made in the half-century; in the early days, when Col. Crompton set out to make electric lighting practical, very little was known about the subject, and his pioneering work was most remarkable. Col. Crompton commenced the supply of electricity at Kensington Court when no means of distribution existed, and he devised the first good commercial system of mains for supplying electric lamps in parallel. To-day we could hardly realise the difficulties that were met with in those times. It was Crompton's early installations that inspired him (the speaker) with the desire to do electrical work.

Col. Crompton, responding to the toast, said that nothing could give him greater pleasure than that Dr. Ferranti should say that his work led him to start on his marvellous career. Dr. Ferranti was the greatest electrical engineer in the world; all modern progress in electrical distribution was owed to him, and he was tackling all the difficult a.c. problems when he (the speaker) was working on d.c. What success he himself had had was a diplomatic success—always trying to induce people to believe him. Sixty years ago he developed mechanical road transport in India, but when he came home his proposals were rejected, and he turned to electrical work. The secret of his career was an intense curiosity to see how things would work, combined with a reliance on "team work," to which he owed all his success.

Col. R. K. MORCOM, C.B.E., proposed "The Electrical Industry," remarking that they must get away from the catchword "Ring" and visualise the real unity of this great industry, symbolised in Col. Crompton, who embraced all departments in himself. It was necessary for the whole industry to think British, be British, and buy British. Every time an important contract went abroad we helped our competitors, and every order taken at a rotten price weakened ourselves.

Mr. GEORGE BALFOUR, M.P., responded, recalling his association with Col. Crompton for a quarter of a century. Regarding team work, he said that nothing great was accomplished by any one man, but by those who disregarded self and gave full credit to the whole team. Electricity had not been developed in this country as it should have been, owing to legislative fetters; we were now free to go ahead, and it was our duty to do our best under the law as established. The Central Electricity Board had set out to work the new Act in the best possible spirit.

Mr. E. REEVES proposed "Our Guests," commenting on the presence of seven past presidents of the Institution of Electrical Engineers to do honour to Col. Crompton.

Mr. LL. B. ATKINSON responded, pointing out that Col. Crompton not only established the first concern in this country to manufacture machines and appliances for electric lighting, but also discovered Mr. P. W. Willans, with notable consequences to the electrical industry; he had done valuable work in connection with measurement, standardisation, automobilism, and road improvement.

Mr. E. J. Fox proposed the toast of "Crompton Parkinson," remarking that the blending of personnel of a young and vigorous firm with the old Crompton interests was bound to be fruitful; and Mr. FRANK PARKINSON responded, claiming that team work was responsible also for the success of Parkinson Brothers. To develop the Empire they needed a strong organisation at home, co-operating to strengthen the industry and not to raise prices, nor to be controlled by any foreigners, even if they were cousins. "Crompton Parkinson" was out for the development of the British Empire by British manufacturers.

After the dinner a reunion took place in a room where a number of interesting exhibits of early Crompton products were to be seen.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1926.

21,790. "Electrical furnaces." American Resistor Corporation. September 3rd, 1925. (257,949.)

21,791. "Electrical heating apparatus." American Resistor Corporation. September 3rd, 1925. (257,950.)

22,158. "Imposing polarisation phenomenon on dielectric substances." A. Joffe. September 8th, 1926. (Addition to 257,080.) (286,747.)

30,587. "Diaphragms of electrically-operated sound-producing horns and the like." T. S. Rogers. December 3rd, 1926. (Cognate application 23,152/27.) (286,759.)

30,670. "Housings and operating means for radio indicators or the like." Kurz Kasch Co. June 18th, 1926. (272,845.)

30,631. "Electric welding plants and dynamo-electric converting apparatus for use therein." Quasi-Arc Co., Ltd., and R. J. Musto. December 3rd, 1926. (Cognate application 23,504/27.) (286,762.)

30,922. "Method of heat-treating loaded conductors." W. E. Beatty (Western Electric Co., Inc.). December 6th, 1926. (286,757.)

30,962. "Sound-reproducing apparatus." A. H. Brackensey. December 7th, 1926. (286,768.)

31,057. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. Saville. December 7th, 1926. (286,773.)

31,150. "Apparatus and methods for the comparison of high alternating voltages." B. A. G. Churcher and Metropolitan-Vickers Electrical Co., Ltd. December 8th, 1926. (286,775.)

31,294. "Ignition systems for internal-combustion engines." H. E. Fellows and J. Walters. December 9th, 1926. (286,783.)

31,405. "Reproduction of sounds." H. J. Kuchenmeister. December 15th, 1925. (263,131.)

31,465. "Circuits and apparatus for use in amplifiers working at radio frequencies." R. L. Cleaver. December 11th, 1926 (Cognate application 8,937/27.) (286,792.)

31,495. "Means for switching-in alternative sources of electric power." E. C. Blem. March 15th, 1926. (267,469.)

31,632. "Sound recording and reproducing apparatus." W. F. Croll. December 13th, 1926. (286,799.)

31,668. "Magnetisable materials for magnetic cores for transformers and inductive apparatus and the like for wireless purposes." K. Higginson and Radio Instruments, Ltd. December 14th, 1926. (286,800.)

31,828. "Prepayment-meter devices." H. Lister and Metropolitan-Vickers Electrical Co., Ltd. December 15th 1926 (286,803.)

31,992. "Holders for electric resistances." Oliver Pell Control, Ltd., and C. Oliver. December 17th, 1926. (286,805.)

32,122. "Electric heating resistances and elements." Norris Warming Co., Ltd., and L. A. Booth. December 18th, 1926. (286,807.)

32,752. "Current collecting device for dynamo-electric machines." Ruthardt and Co. Ges., and A. Schneider. December 28th, 1926. (286,813.)

32,829. "Electrodes for electric batteries." Compagnie Française pour l'Exploitation des Procédés Thomson-Houston. May 17th, 1926. (271,034.)

32,833. "Variable electric condenser." F. R. Johnston. December 29th, 1926. (286,816.)

33,001. "Sound-boxes for sound-reproducing machines." H. A. Gaydon and T. Hough. December 31st, 1926. (286,820.)

1927.

37. "Brazing, soldering or welding of metals by fusion." N. R. Davis and Metropolitan-Vickers Electrical Co., Ltd. January 1st, 1927. (286,823.)

346. "Telegraphic devices for calling and other purposes." K. L. Wood, C. Nias, and Eastern Telegraph Co., Ltd. January 5th, 1927. (286,829.)

467. "Mechanical switches for electric advertising." H. Schifner. September 20th, 1926. (277,606.)

486. "Prepayment electric meters." R. Hornby and E. H. Wratten. January 7th, 1927. (286,832.)

1,735. "Electric relays or switches." General Electric Co., Ltd., and A. E. Angold. January 20th, 1927. (286,836.)

2,204. "Radio direction-finders, Hertzian compasses, and the like." H. Busignies. January 25th, 1927. (286,840.)

2,332. "Attachment of diaphragms or oscillation members for loud-speakers." H. Wade (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). January 26th, 1927. (286,841.)

3,518. "Holders for globes or the like for electric or other lamps." W. H. Baker and Metropolitan-Vickers Electrical Co., Ltd. February 8th, 1927. (286,847.)

3,719. "Electric lampholders." F. W. Yates and J. K. W. Manufacturing Co., Ltd. February 9th, 1927. (286,852.)

4,612. "Drums for electric cables and the like." W. T. Henley's Telegraph Works Co., Ltd., and W. C. Jackson. February 18th, 1927. (286,859.)

4,690. "Electric accumulators." G. H. Trotter. February 19th, 1927. (286,863.)

5,563. "Electric water heaters." M. S. Gazelle. February 28th, 1927. (286,872.)

5,980. "Liquid electric controllers." A. West & Co., Ltd., and H. Brooke. March 3rd, 1927. (286,874.)

10,334. "Electric switch-operating device." F. Whipp, Whipp & Bourne, Ltd., and Mather & Platt, Ltd. April 14th, 1927. (286,909.)

10,510. "Cooling of electric machines." F. Windhausen. April 19th, 1927. (Convention date not granted.) (269,597.)

14,047. "Manufacture of multi-core electric cables." British Insulated Cables, Ltd., W. Atherton, and E. Warde. May 25th, 1927. (286,929.)

14,097. "Vacuum electric tube devices." Westinghouse Electric & Manufacturing Co. May 27th, 1926. (271,885.)

14,642. "Electrical amplifying systems." B. F. Miessner. June 19th, 1926. (272,887.)

15,836. "Protective systems for electrical transformers." Metropolitan-Vickers Electrical Co., Ltd. June 16th, 1926. (272,909.)

16,636. "Fuse cut-out for electric circuits." J. Brown and E. Barrett. June 22nd, 1927. (286,943.)

17,197. "Electric imitation coal fires." C. W. Denny. June 28th, 1927. (286,944.)

17,329. "Means for automatically switching on the lighting set of a vehicle." J. Zweigenhaft and G. Russ. August 30th, 1926. (276,630.)

18,081. "Optical devices suitable for use in picture telegraphy, television, high-speed facsimile telegraphy, and the like." Telefunken Ges. fur Drahtlose Telegraphie. August 6th, 1926. (275,583.)

18,384. "Circuit interrupters." British Thomson-Houston Co., Ltd. July 12th, 1926. (274,120.)

18,634. "Geared electromotor drives for shaking conveyors and the like devices." A. Eickhoff (trading as Eickhoff Maschinenfabrik, Geb.). November 10th, 1926. (280,499.)

19,489. "Means for giving warning of and preventing damage by excessive current in electric circuits." G. O. A. Cousin. July 22nd, 1927. (286,961.)

20,045. "Electric couplings and the like." L. H. Wadsworth. July 28th, 1927. (286,966.)

20,723. "Thermionic valves or electron discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 7th, 1927. (286,970.)

21,029. "Setting device for Röntgen tubes." Siemens-Reiniger-Veifa Ges. fur Medizinische Technik. September 25th, 1926. (277,945.)

21,126. "Protecting device for high-tension apparatus." Siemens-Reiniger-Veifa Ges. fur Medizinische Technik. September 10th. 1926. (Addition to 275,235.) (277,305.)

22,029. "Electric incandescent lamps and the like." General Electric Co., Ltd. September 6th, 1926. (276,992.)

22,882. "Duplex switch combined in a radio receiver." B. Gordon. August 31st, 1927. (286,981.)

24,626. "Radio receiving apparatus." Igranic Electric Co., Ltd., and L. E. Currah. September 19th, 1927. (286,991.)

24,753. "Circuit arrangement for high-frequency heating devices, particularly adapted to smelting furnaces." Siemens & Halske Akt. Ges. September 21st, 1926. (277,968.)

26,222. "Photo-electric cells and circuit arrangements therefor." Telefunken Ges. fur Drahtlose Telegraphie. October 15th, 1926. (279,068.)

26,330. "Thermionic valves or electron discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. December 30th, 1926. (282,712.)

26,331. "Thermionic valves or electron discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 26th, 1927. (Addition to 282,712.) (286,999.)

26,621. "Variable condenser for use with oscillating circuits and for similar purposes." I. Martelli. October 9th, 1926. (278,748.)

27,086. "Radio transmission systems." Dr A. Esau. October 29th, 1926. (279,823.)

27,969. "Liquid-cooling radiators particularly for electric transformer tanks." Akt. Ges. Brown, Boveri et Cie. November 13th, 1926. (280,517.)

29,157. "Combined electric pocket torch and writing pad or tablet." F. Lochmann. November 1st, 1927. (287,015.)

30,804. "Means for bringing into action alternating-current static frequency transformers." C. Lorenz Akt. Ges. January 6th, 1927. (283,170.)

1928.

1,784. "Unidirectional electric current-carrying devices or rectifiers." Metropolitan-Vickers Electrical Co., Ltd. January 19th, 1927. (283,901.)

2,445. "Trackless electric vehicles." Siemens-Schuckertwerke Akt. Ges. January 29th, 1927. (284,332.)

6,269. "Production of thin electric insulating layers having a high resistance to leakage" A. Joffe. September 8th, 1926. (Divided application on 286,747.) (287,039.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 28th. In the case of foreign applications, the names and addresses of the British representatives are also given :—

X.L. Manchester (lettering and design). No. 477,970. Class 8. Electric batteries for radio-telephonic purposes.—R. W. Smith, 92, Seymour Grove, Old Trafford, Manchester.

B.E.K. (lettering and design). No. 479,548. Class 8. Radio-telephonic batteries and accumulators.—Die Batterien & Elements Fabrik Koch & Kruger, Berlin. (Buckeridge & Braune, 3 and 4, Clement's Inn, Strand, W.C.2.).

Mecaphon. No. 487,632. Class 8. Apparatus for measuring the quantity of X-rays, light rays, heat rays, and the like.—S. Strauss, Vienna. (Haseltine, Lake & Co., 28, Southampton Buildings, Chancery Lane, W.C.2.).

Tetron. No. 488,020. Class 8. Thermionic valves.—J. R. Sinclair, 2, Mornington Avenue, Ilford, Essex.

Climax. No. 488,398. Class 8. Television apparatus.—Climax Radio Electric, Ltd., Quill Lane, Putney, S.W.15.

Ray-O-Vac (lettering and design). No. 485,932. Class 13. Electric torches and cases therefor.—French Battery Co., Madison, Wis., U.S.A. (White, Langner, Stevens & Parry, Jessel Chambers, 88-90, Chancery Lane, W.C.).

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

AYR.—Bakery extensions, 62, Carrick Street (£2,700), for James Gilchrist, Ltd., 233, High Street.

AYRSHIRE.—Additions to hosiery factory at Irvine (£1,700); Messrs. Cunningham (Ltd.), proprietors.

BATH.—Reconstruction, City Statutory Hospital, for the T.C. (£50,000), F. P. Sissons, city engineer. Boys' secondary school for the Borough E.C. (£40,000); director of education.

BEXHILL.—50 houses, Burnt Farm; borough engineer. Pavilion, Polegrove and Promenade wall; borough engineer. Houses, Collington Avenue, Cooden Drive, Watermill Lane, and Barnhorn Road; J. E. Maynard, Collington Avenue.

BOURNEMOUTH.—Extensions to Central Railway Station for the Southern Railway.

BRAINTREE.—Additional 128 houses, for the R.D.C.; surveyor.

BRIGHTON.—22 houses, Hollingdean Terrace; C. Blaker. Alterations, showrooms, &c., Hotel Metropole, King's Road; Gordon Hotels, Ltd. Memorial hall, Richmond Hill; trustees, Church of St. John the Evangelist. Alterations, The Royal Spa, Queen's Park; Hooper, Struve and Co., Ltd. Improvements at Pavilion; Pavilion director.

BROMLEY (Kent).—Additional 240 houses and flats, Magpie Hall Lane, for the T.C.; Harold Cliffe, acting borough engineer. Houses (59), Palace View and Murray Avenue, for H. F. Thoburn.

BURTON-ON-TRENT.—Extensions, Bretby Hall, Orthopædic Hospital, for the C.C.; Martin & Martin & W. H. Ward, architects, 106, Colmore Row, Birmingham (returnable deposit of £2 2s.).

BURY (Lancs.).—Garage for John Eastham & Sons, Ltd., haulage contractors; C. R. Cooper, architect, 20, Market Street.

CHICHESTER.—Extensions, Chichester School; J. Auty, architect, Flint House.

CHORLEY.—Extensions, Leather Works, Fellery Street; T. Brimley & Co. 24 houses, St. Peter's Street; J. Fairclough & Sons. 27 houses, Marlborough Street; J. W. Lee & Co.

COVENTRY.—Factory, West Orchard, for the Midland Bent Timber Co., Ltd.

CROYDON.—58 houses, Coldwell Road; A. Duckit. 35 houses, Grange Road, Scratchley Bros.

DUMFRIES.—Alterations at County Hotel; H. A. McLachlan, proprietor.

DUNDEE.—Central Police Office accommodation (£40,000); G. Baxter, city engineer.

EDLINGTON.—Two schools (1,000 places), for West Riding E.C.; education architect, County Hall, Wakefield.

ETCHILHAMPTON (Devizes).—Additions to Etchilhampton House, for Captain Norman Rouse; T. Stevens & Sons, architects.

FORFAR.—Kitchen and staff accommodation at Infirmary; D. Watterston, architect.

GLASGOW.—Cinema, Partick; Thomas Ormiston, solicitor, 6, Brandon Street, Motherwell. Hall at North Woodside Road; Albert E. Pickard, 115, Trongate. 852 houses and shops, Knightswood Estate; housing director. Garage for 100 'buses, Butterbiggins Road; tramway manager. Extensions, Belvidere Hospital (£14,600); city engineer.

HALESOWEN.—Reinstatement of Crown Works, electrically equipped, for G. B. Parks, Ltd.

HARROGATE.—Hospital, Elcock & Sutcliffe, architects, Avenue House, 21, Northumberland Avenue, London, W.C. (returnable deposit of £2 2s.).

HIGH WYCOMBE.—Factory extensions, Castle Bros., Desborough Park Road; R. Howland & Son, Denmark Street; E. Gomme, Spring Gardens; Birch & Alpe, Kitchener Road. Chair factory, Leigh Street, for W. Birch, Ltd.

HOLBEACH (Lincs.).—Re-erection of Barrington flour mills, electrically equipped, for A. W. Tindall.

HYDE (Cheshire).—Houses (66), Clarendon Road Estate, for Frank Lord, Wallshaw Street, Oldham.

IRISH FREE STATE (Dromcolliher, Co. Limerick).—Rebuilding, Springfield Castle, for the Hon. R. F. Deane Morgan; R. Walker & Son, architect, 17, South Mall, Cork.

KINGSTON.—Extensions, County Offices (£103,500); A. Vincent Harris, architect, 29, St. James Square.

LEAMINGTON.—Bakery, Bedford Street; Burgis & Colbourne, Ltd. Stores, Eagle Foundry, Clarence Street; S. Flavel & Co., Ltd. 60 houses, Rusholme Estate; borough engineer. Sewage disposal works (£45,000); borough engineer. Art gallery (£6,000); Kelley & Son, Coventry.

LEICESTER.—Clinic, Marriott Road; J. C. Kellett & Sons.

LIVERPOOL.—Billiard hall, Norris Green Estate, for a new company. Foreshore reclamation and promenade, Otterspool (£100,000); city engineer.

LONDON (Hackney, E.).—Workshop, garages and stable, Amhurst Road; Commercial Structures, Ltd. Rebuilding 93-100, Stoke Newington Road; Hobden & Porri. Factory, Ridley Road; J. Jennings & Sons, Ltd.

(Ilford, E.).—23 houses, Derwent Gardens; T. Anders. 55 houses, Ridgway Gardens; T. B. Goodwin. Development, Hedgman's Farm Estate; Sir Hamilton J. Hulse.

(Strand, W.C.).—Buildings on Aldwych site; Perry & Bell.

(E.C.).—Reconstruction Midland Bank, Princes Street; directors. Rebuilding National Provincial Bank, Princes Street; directors.

(Islington, N.).—Two blocks containing 134 tenements, Ring Cross Estate; Gee, Walker & Slater, Ltd., Pall Mall.

MACCLESFIELD.—Houses (136), for the T.C.; J. Jones and Sons, Ltd., builders, Woolton, Liverpool.

MALDEN.—Extensions, Springfield Mental Hospital (£6,000); W. H. Gaze & Sons, Ltd., Kingston.

MANSFIELD.—Parochial hall with lighting and heating; Bocock & Dean, architects, Sutton-in-Ashfield; J. Warner, builder.

MERTHYR.—Cinema Castle Hotel site (revised scheme); F. Price. Shops and offices, High Street, for F. S. Simons; Johnson, Richards & Rees, architects, Glebeland Street (returnable deposit of £1 1s.).

MANCHESTER.—Alterations to the Child Welfare Centre; city architect, Housing Department, Civic Buildings, 1, Mount Street. Extension of Ancoats Hospital (£100,000); Committee of Management. Housing scheme (1,500), Wythenshawe, for the T.C.; city surveyor.

MILTON REGIS.—Additional housing scheme (90), for the U.D.C.; A. W. Callaway, surveyor.

PRESTON.—Municipal offices (£6,850), for the T.C.; Thomas Croft & Sons, Ltd., builders.

PLYMOUTH.—Development, Swilly Estate; Mr. F. Westcott.

RAMSGATE.—Tea room and shelter pavilions, with lighting (deposit of £3 3s.) and lift (deposit of £2 2s.), St. Lawrence Cliffs Estate, for the T.C.; Basil C. Deacon, architect, 33, King Street, Luton, Beds.

ROMFORD.—Senile dementia block (£21,975), for the B.G.; F. G. Bethley, builder, Westcliff, Southend-on-Sea. Hospital extensions (£150,000), for the B.G.; clerk.

SELSDON (Surrey).—26 houses, Littleheath Road; Richard Costain & Sons.

SITTINGBOURNE.—Additional 30 houses, for the U.D.C.; M. W. Lashmar, surveyor.

SMETHWICK.—Additions, Mineral Water Works, Halfords Street; Cresswell & Son.

SUTTON.—Girls' school; Surrey Education Committee.

THORPE SATCHVILLE (Melton Mowbray).—Additions to Thorpe Satchville Hall, for Major Gerard Leigh.

TYNEMOUTH.—Development, Ingleside Estate; Exors., Mr. Joseph Robinson. Shops and flats, Chirton Green Estate; Chisholm & Co.

WALSALL.—Conversion of Abelwell Street Church into central hall and mission centre (£15,000), for the Wesleyan trustees; secretary.

WAKEFIELD.—Maternity hospital, Clayton site; city engineer. Petrol depôt, Calder Vale Road; Midway Oil and Storage Co.

WARRINGTON.—Hall and manse for the trustees of St. John's Presbyterian Church, Wilderspool Causeway; secretary.

WHITBY.—Museum, Pannett Park; Havs & Gray, architects, Wingate, Co. Durham (returnable deposit of £1 1s.). Alterations, Spa Theatre, for the U.D.C.; Frank Tugwell, architect, Scarborough (returnable deposit of £1 1s.).

WHYTELEAFE.—Extensions, County School for Girls; Surrey Education Committee.

YEOVIL.—Additional housing scheme (28), for the R.D.C.; housing architect.

YORK.—275 houses, Bad Bargain Lane; 50 Hull Road, and 22 Fifth Avenue; city engineer. Rehousing scheme, Hope Street area; city engineer. Extensions, St. George's Baths (£19,000); Baths Committee.